Choosing The Right Printer

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The Leading Magazine Of Home, Educational, And Recreational Computing

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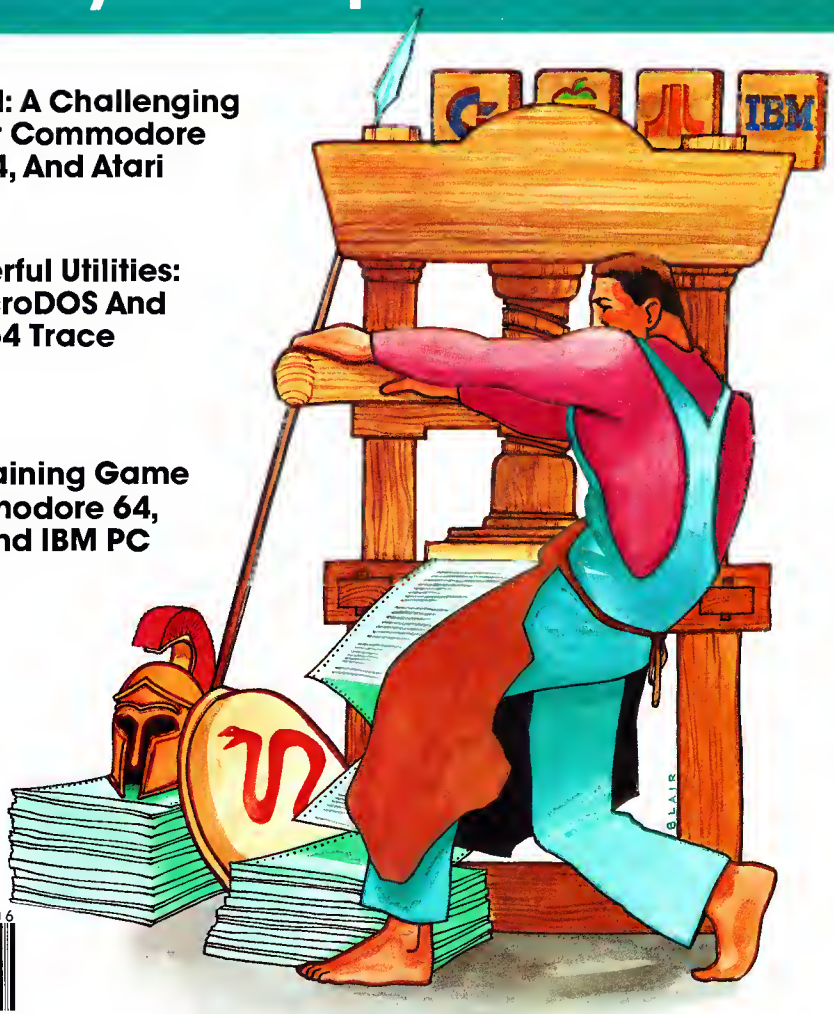

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EDITOR'S NOTES

Apple, in an extravaganza at San Francisco's Moscone Center yesterday, formally introduced their new personal computer, the Apple IIc. Discussion with over one dozen dealers revealed a reaction which was uniformly positive, with the only concern being, "What about the Apple IIe?"

Significantly, Apple's massive entry into the home and educational computing market, backed by an initial advertising push in excess of $15 million is being handled by their existing dealer network. While some units will be sold through department store or chain outlets, the majority will flow, unbundled, through Apple's dealer group. The rationale given for not bundling the system was that dealers would be better able to customize the system for prospective purchasers.

During the course of all of this, Apple revealed that they have now sold almost 2 million Apple II's since its introduction, and over 50,000 Macintoshes. By the time you read this, the external drive should be available for the Macintosh, and many dealers will have Apple IIc's in stock... or at least flowing through their stores. Impressively, both of Apple's recent major announcements have been coupled with the actual shipment of the computers being introduced.

Apple expects the IIc to be a forceful competitor in the home market, and stresses that the product is specifically targeted for the serious personal computer user. Will the IIc succeed? Pricewise, it's competitive with the high-end PCjr system from IBM. It contains the same amount of RAM (128K), and built-in BASIC in ROM (albeit a smaller version with less power than that in the Cartridge BASIC of the PCjr). The IIc has one built-in disk drive, a keyboard that's a bit more standard than the frequently criticized keyboard of the PCjr, and an available software library of over 10,000 Apple II programs that will be compatible with the IIc.

By the fall, Apple will be shipping a $600 flat panel display for the IIc which will display 24 lines by 80 characters, and fully complement the already integrated design of the rest of the unit. The disk drive, for example, is built into the side of the combination computer/keyboard housing.

ProDOS, the operating system, is fully compatible with Apple DOS 3.3, and with a very minor change, DOS 3.2. Almost two dozen leading software vendors were exhibiting products for the IIc at the introduction, and Apple indicates that it's working with more than 100 vendors at present.

Has Apple come home? For now, it certainly appears that way. You can anticipate a rapid expansion of COMPUTE!'s editorial coverage to include the industry's latest entry into the field of home and educational computing. Next month we'll have a full feature on the IIc, and further analysis of its future.

Until then, enjoy your issue.

Editor In Chief

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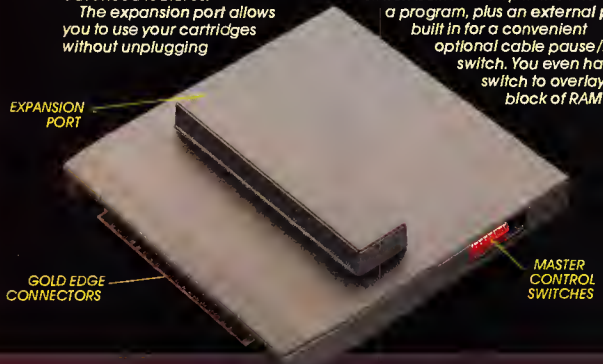

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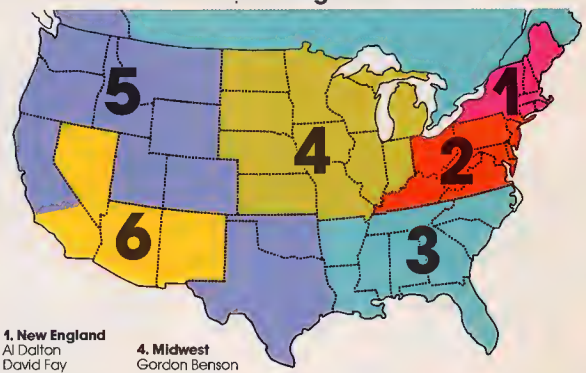

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The Editors and Readers of COMPUTE!

How To Turn A Computer On

I have a question concerning peripheral equipment. When first turning on the computer equipment, I've heard that it is advisable to turn on the accessories first and the computer last. Is it okay to have all three units (computer, disk drive, and printer) plugged into a single power strip, and turn everything on at once merely by turning the power strip on?

Robert C. Leuten

No. Computers, and electronic equipment in general, often have circuits that protect against damaging surges of power when equipment is first turned on. By leaving all your equipment on and turning on the power strip, you defeat this circuitry. This could damage your equipment.

Also consider that the more devices on the power strip, the bigger the initial surge will be. So generally, it's a good idea to turn on each piece of equipment in the proper order, one at a time.

Another commonly asked question is, "In what order should I turn on the computer equipment?"

The Commodore 1541 disk drive owner's manual states that the computer should always be turned on last. Since the printing of that manual, Commodore has issued an update bulletin concerning the proper order for turning on the computer and its peripheral devices. Here are their recommendations:

1. *Computer, disk drive, printer*
2. *Computer, disk drive, disk drive*
3. *Computer, disk drive, disk drive, printer*

Variables In Atari Filenames

Is there any way you can assign a filename to A$, and then open an Atari disk file named A$?

James Beach

Sure. Let's say someone INPUTs the name into a string:

```
10 DIM T$(40),A$(20)
100 PRINT "Filename":INPUT T$
```

You can then create a disk filename:

```
110 A$="D:":A$(3)=T$
```

now we OPEN the file, for read access:

```
120 OPEN #1,4,0,A$
```

Disk Drive Door Dust Defense

I own a 1541 disk drive, and I would like to know if I should keep the disk drive door closed when it is not in use. I have read that if you keep the door closed, it will prevent dust from getting into the drive. On the other hand, I've also read that keeping the door closed also keeps the read/write head down, and the constant pressure will damage the head. Which would be better?

Jerrell F. Schivers

There is no compelling argument on either side of this debate. The pad that the read/write head rests on is soft, and shouldn't damage it with the door closed. On the other hand, dust can still find ways in with the door closed.

Tokenized Commands In TI Extended BASIC

Recently, I was working in Extended BASIC on my TI-99/4A and found that I could enter commands while in programming mode using the CTRL key. For instance, holding the CTRL key and pressing ; produces the PRINT command after the line is LISTed. (Note: This won't work in immediate mode or in console BASIC.)

As it turns out, most keys in conjunction with the CTRL key produce a command. I've also discovered that only one such command can be entered per line in this fashion. Can you tell me the significance of all this?

Steve Hayner

Like most computers, TI represents its BASIC commands internally in a tokenized, or numerically-coded, abbreviated form. Apparently, certain keystrokes generate the same codes as some tokenized commands.

This technique is indeed limited to the Extended BASIC programming mode. Also, as you say, only one command can be entered per line with this method. These severe limitations, along with the absence of documentation in the TI-99/4A reference manuals, lead us to believe that the use of tokenized commands in this manner is allowed through a quirk in the system. They are probably not a design feature. Regardless, the method that you've described does offer a shortcut for entering commands in certain instances.

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We've found that a few tokenized commands can also be keyed in with the FCTN key. Here's a list of the CTRL- and FCTN- keystrokes, and the commands they access:

Key	Command	Key	Command
CTRL 1	TO	CTRL D	IF
CTRL 2	STEP	CTRL F	GOTO
CTRL 8	OPTION	CTRL G	GOSUB
CTRL 9	OPEN	CTRL H	RETURN
CTRL 0	THEN	CTRL J	DIM
CTRL +	CALL	CTRL K	END
CTRL Q	UNTRACE	CTRL L	FOR
CTRL W	READ	CTRL ;	PRINT
CTRL E	GO	CTRL Z	REM
CTRL R	INPUT	CTRL X	STOP
CTRL T	RESTORE	CTRL V	NEXT
CTRL Y	DELETE	CTRL N	BREAK
CTRL U	RANDOMIZE	CTRL M	LET
CTRL I	DEF	CTRL >	ON
CTRL O	UNBREAK		
CTRL P	TRACE	FCTN 0	XOR
CTRL /	AND	FCTN ;	NOT
CTRL A	ELSE	FCTN /	OR
CTRL S	DATA		

Modifying The Atari 400 Monitor Cable

I have owned an Atari 400 for a little more than a year now, and I'm considering the purchase of a monitor. The monitor I want to buy has an RCA-type jack, but my computer doesn't. Is there a way I can hook up a monitor to my computer without any extra cables?

Davy Wong

It's not that simple. The 400's video output is designed to work with a television set. The signals generated by the RF modulator won't drive a monitor. Hooking up a monitor would require rerouting the 400 circuitry to bypass the RF modulator, or installing a device to convert the modulator's signals.

Protected Disks

What exactly is the difference between *write-protected* and *copy-protected* disks? Can these protection devices be evaded on disk? Also, if my friend buys a program on disk, is there any way to transfer it to tape for me?

Jon Regen

Write-protected disks are disks that can be read from, but not written to. As you hold a disk in the normal fashion, and slip it into your disk drive, you'll notice a little square notch cut out of the left side of the protective sheath. Inside your disk drive are a light-emitting diode and a phototransistor.

These two components are in-line with each other, and when you insert a disk, the light from the LED shines through the notch and into the phototransistor. If the transistor detects the light, then the drive is allowed to write to the disk.

To write-protect a disk, place one of the sticky tabs included with the disk over the square hole. This will stop the light from reaching the phototransistor, and signal the drive not to write to this disk. An attempt to write will cause the red error light on the front of the drive to blink.

Copy protection is a different matter. More often than not, commercial software is copyrighted. This means that you may not (under penalty of law) make a copy for any purposes other than specified by the software distributor. Software manufacturers use several different methods to prevent copying, from different programming techniques to special coding on the diskette.

As for making a tape copy of the programs, the same answer applies. The copyright laws cover all copies, whether on tape or disk. Copies should not be made unless permitted by the software company.

Gotcha! Champions

My family has a VIC. This week we have been playing "Gotcha!" (COMPUTE!, February 1984) and I managed to get to the eighteenth screen. Since you mentioned that no one had reached this level yet, I thought I would let you know. When I got to the end it flashed yellow and said, "You made it!!!!"

Mark Crow

P.S. I am 11 years old, and I live in Cambridge, Ontario.

You said that no one has ever survived 18 rounds of "Gotcha!" Well, I did, and I have two reliable witnesses—my mom and dad. They saw me make 240 points and survive 19 levels.

I am 12 years old and I go to Grant Middle School in Springfield, Illinois.

Eric Jurgen

P.S. My dad thinks I fixed the machine.

Congratulations to both of you.

Disappearing VIC?

I own a VIC-20. I would like to know if Commodore has decided to stop making VIC-20s. If so, why? If they have, will you be able to buy Commodore software and hardware for it?

Jon Fedyk

We've received many inquiries about this. Commodore asserts that they do not now plan to stop production on either the VIC-20 or the 64. Commodore and third-party software and hardware for both computers should also continue to be available for some time.

As a point of interest, there are now two million VICs out there. ©

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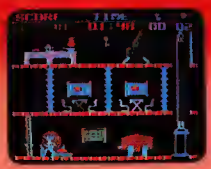

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Choosing The Right Printer
The Easy Way To Hard Copy

Selby Bateman, Features Editor

If you're thinking about buying a printer, remember that what you don't need in a printer can be as important as what you do. Save yourself time, money, and major headaches by following a few well-planned steps.

How can you choose the printer that's right for you? Listen to some experts:

"The most important thing you need to know when buying a printer is what in the world you're going to do with the thing," says Craig Ringuette, merchandising manager for Okidata. "That's the key. Once you know that, then there are clearly a lot of ways to be directed."

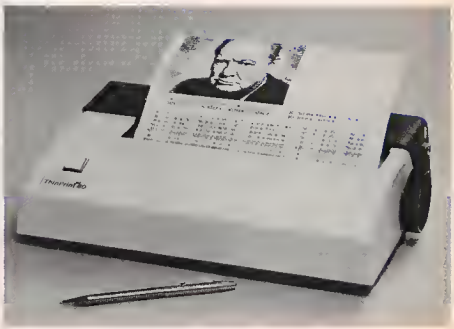
"You have to decide the quality of the print you want," states Rick Osgood, national technical support manager for Star Micronics. "Do you want dot matrix—which is going to print just draft quality—or do you require something a little better, like near-letter quality?"

"A buyer's first question will be, 'Will this work with my system?'" says Charles Srogus III, product line manager for Micro Peripherals, Inc. "And the second question will probably be, 'Will it print graphics? Will it do the fun things I see them demonstrating on television or at the local computer fair?'"

"You need to consider whether you want fully formed letter characters or whether dot matrix is adequate," adds Ken Bosomworth, president of International Resource Development, Inc., a market research firm. "And you should certainly think about whether or not you want color; and whether, if you get color, you can do anything with it."

Lower Prices, Better Quality

These printer manufacturers agree that buying a printer which works with your computer doesn't have to be a confusing or frustrating process. Lower prices and better quality are trends which have been accelerating during the past year. Computer owners now have a greater choice of reasonably priced printers than ever before. (See "The Inexpensive Printers Of 1984" in this issue.)



Axonix Corporation's ThinPrint 80, a $279, four-pound, battery-powered, portable, thermal printer that fits into one side of a briefcase and prints full-page text and graphics.

Computer printers are now a $2.4 billion industry. Leading printer companies such as Okidata, Epson, Ricoh, Canon, Micro D (Abati), Micro Peripherals, Star Micronics (Gemini), Diablo, Axiom, Alphacom, and others are competing fiercely to make their printers the most versatile, dependable, and cost-effective.

But with so many choices, you need to have a basic understanding of what kinds of printers there are. Then define your specific needs.

The two most popular types of printers for microcomputers are the dot matrix impact systems and daisy wheel printers. Thermal printers are another category. There are also several newer types of printers—ink jet, thermal transfer, and laser—which are already beginning to affect the personal computer printer market.

Dot matrix printers are less expensive, and produce images on paper much like those displayed on your computer monitor or television set—patterns of dots arranged to form characters or graphic figures.

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Stacked Wires That Strike

There are several types of dot matrix systems, the most common of which uses stacked wires that strike in various configurations against an inked ribbon to form characters on paper.

The early dot matrix printheads usually were limited to five wires horizontally by seven vertically. This resulted in crude, often difficult-to-read rectangular characters, with ill-formed descending arms on the letters q, y, p, g, and j, for example. More recently, more wires have been added, producing more fully formed characters.

Cardco's LQ/2 is a $349.95 letter-quality portable printer which prints 12 characters per second, and has built-in interfacing for all Commodore personal computers. It is also compatible with the PC, PCjr, TRS-80, and other computers with parallel Centronics printer output.

A daisy wheel printer, on the other hand, has a printhead composed of formed characters which are located on the ends of spokes—or petals—emanating from a central, spinnable hub. The printhead looks like a high-tech daisy, hence the name. Daisy wheels leave an image very similar to a good typewriter, but print much more rapidly.

Closing The Gap

Daisy wheel printers generally are more expensive than dot matrix impact printers. And some newer dot matrix printers even rival the high-quality printouts from the daisy wheel printers.

Thermal printers actually burn off a coating on special thermal paper. Their costs are relatively low and their quality good. But thermal printers require special heat-sensitive paper, which is more expensive in the long run and subject to eventual decay.

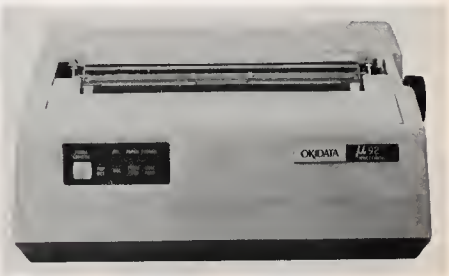
How Fast Is Fast?

Different printers operate at different speeds. Generally, the faster the printer, the higher the cost.

"At the entry level, you're looking at a low-end 100 to 140 characters-per-second (cps) printer, for anywhere from $400 to $600," says Star Micronics' Osgood. "That can go all the way up to a printer with 200 to 250 cps at upwards of a thousand dollars."

Do you need a printer that prints twice as fast as the low-end model, if that means you'll have to pay twice as much or more in order to get it? This is where the tradeoffs start, and a smart shopper will know what his or her needs will be.

"A printer is a very slow device—it's one of the slowest devices you'll hang on your system," says Osgood. "You'll want to take into consideration the amount of buffering a printer has (a temporary storage area in the printer into which the computer can dump your data). If you can only have a one-line buffer on the printer, then you're going to tie up your computer for a long time. If you have a 16K or an 8K or larger buffer, then you can off-load your data from the system in a much quicker time, freeing your computer to do other work."



Okidata's $599 Microline 92 dot matrix printer can print 160 characters per second and, for correspondence quality, 40 characters per second.

Bidirectional And Logic-Seeking

In addition to sizable buffers, the faster printers put characters on paper both forward and backward rather than wasting the carriage-return time that occurs when a printhead must return to the left margin after each left-to-right pass. This is called bidirectional printing. Another advanced speed capability is logic-seeking, in which the carriage covers only the area of the line on which print is to appear rather than running from margin to margin on every return.

Okidata's Ringuette suggests that you ask, "Do I really need 200 or 300 cps? Is that important to what I'm doing? Can I live with 100 cps?"

The answer to those questions will be an important part of your decision on which printer you buy, he adds.

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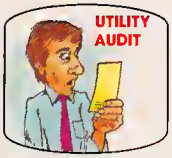

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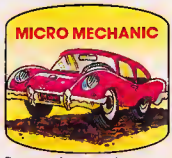

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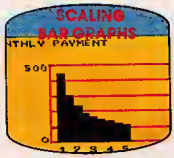

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From Dot Matrix To Laser Print

The Changing Face Of Printers

Selby Bateman, Features Editor

"Not too many people use horses and buggies anymore," says Jim Hafer, supervisor of product evaluations for Micro D, which markets the Abati LQ20 letter-quality printer.

Hafer thinks that changes in printer technology could challenge, and possibly even supplant, the present generation of dot matrix and daisy wheel printers.

The staccato chatter of these impact printers appears to be giving way to the quiet hum of thermal transfer, ink jet, and laser printers. Recent advances in all of these technologies make their entry into the mass market a virtual certainty.

"It's probably going to happen a lot quicker than we expect," he says. "There are additional advantages to some of the new printer technologies that are coming out."

Boiling Ink

"Take thermal transfer, which is wax-embedded ink on a ribbon. The printhead actually heats the ink up, boils it, and forces it onto the paper. The image you get on the paper is letter quality from a dot matrix printer," he adds. "And it's actually raised lettering. You can run your fingers across it, and feel the letters. So it provides a really, really high quality output."

Hafer's views are shared by International Resource Development, Inc. (IRD), a market research firm in Norwalk, Conn. Based on a study the company conducted, IRD predicts that dot matrix impact printers will soon lose the dominance they've enjoyed in the printer marketplace.

"In 1983, impact matrix shipments accounted for 72 percent of all unit shipments; by 1993, the figure will be down to 20 percent," the study indicates. "It is not only under-$500, fully formed character printers that will be responsible for the transformation of the microcomputer printer industry."

Low-Cost Contenders

The report predicts that by 1985 thermal transfer printers which use ordinary paper, operate quietly at high speeds, and produce color graphics and near-letter quality text will have 12 percent of the market. By 1993, the market share will be 28 percent.

"The major advantage of impact printers, besides multiple copies, has been the ability to work with ordinary paper rather than some specially coated paper that might be difficult to get, as is the case with thermal printing," says Ken Bosomworth, IRD president. "However, the two major low-cost contenders—thermal transfer and ink jet—also use plain paper. So they have no disadvantages vis-à-vis the impact printer in terms of paper cost."

Thermal transfer printers do have a higher ribbon cost, he notes, since the ribbon can be used only once.

From Clogged Tubes To Cartridges

Although ink jet printers have been manufactured for quite a while, recent technological advances have improved them too. Traditionally, ink jet printers have drawn ink into tubes then shot the ink at high speed onto the paper. When idle for a while, the tubes tended to clog. Ink jet systems also suffered from a reputation for being messy.

But Hewlett-Packard recently introduced a $495 ink jet printer, named the ThinkJet, which uses low-cost disposable ink cartridges. And other companies are working on improved ink jet systems as well.

"We see ink jet printers as being a definite technological competitor," says Ron Ockander, director of sales for Epson. "You create a membrane of ink over a hole, then blast it onto the paper. The problem with filling a reservoir (in older ink jet models), is that it would clog eventually. This way, you don't fill a tube."

Laser Printing

On the horizon, but not yet inexpensive enough for the home, is the laser printer. It works something like a photocopying machine. Instead of using a light-reflecting mechanism to form patterns on a rotating cylindrical drum, however, the laser actually writes on the drum. Electrically charged particles form patterns on the drum where the computer has told the laser to draw.

But the least expensive laser printers cost about five or six thousand dollars. And the most expensive climb to the half-million dollar mark.

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"Even the most optimistic developers of laser printers don't see them coming down below a $2000 selling price," says Bosomworth. "And in the home market, what people are really looking for is more like $200.

"For that sort of price it's a contest between the ultra low-cost daisy wheel type—like the one the Coleco Adam has—or various types of cheap dot matrix printers," he says.

But Micro D's Hafer has a more optimistic attitude about the future of laser printers. "I think the most promising area is laser technology. Canon, for instance, has a raster scan laser printer that will imprint the image onto the drum, and photoelectrically develop it using a chemical developer."

A Laser For The Macintosh?

"It probably won't be on the market until late '84 or '85, and it will retail for from three to five thousand dollars," Hafer says. "It's rumored that Apple will be using that technology for the Macintosh. I don't see how they can effectively use any other type of technology, the reason being that the laser printer actually uses a video signal—a raster scan type of signal—to create the image on the drum. And the Macintosh is a completely video-based screen."

In addition to the Canon laser printer, it's reported that Ricoh of America, Inc., and Xerox are creating similar printers.

Despite the expectations for thermal transfer, ink jet, and laser printers, many industry observers are not ready to assign the dot matrix impact printer to oblivion.

"I'll tell you who will grab the market share," says Charles Srogus of Micro Peripherals, Inc. "It's going to be the (dot matrix) printers that are encroaching on the letter-quality printers. You're going to see an increase in the number of wires and the shape of the wires in the printhead.

"And the people who are going to be the leaders in this are those who have to use that kind of technology to print their language. The Japanese have had to work on this for some time," he says. "They have some very interesting products coming out that will also work in color."

Axiom's $299 dot matrix printer with dot-addressable graphics is plug-compatible with the TI-99/4A.

Ringuette. "In other words, what software packages am I going to run, and what computer am I going to run this on?

"Does the printer really work with that system? People get amazed by the compatibility problem. You get a printer, you hook it up, and it doesn't do anything because it's not compatible," he adds.

When buying a printer, make certain that the printer will work with your particular computer, or that there is an interface you can buy which will make the two compatible. Printer interfaces are usually Centronics parallel or RS-232-C serial types. If you're buying a printer from a store, have the dealer explain what interface you need to get the full capabilities of the printer for your computer.

Questions To Ask

Before you buy your printer, you should also know the answers to the following questions:

The TTP16 is capable of printing **bold face**, **double-strike**, **expanded**, compressed, super^{script}, sub$_{script}$, proportional spacing, underlining, Pica, Elite, and *Italicized print* as well as hex dumps and graphics.

Many dot matrix printers offer a variety of type styles, as does this thermal transfer printer from Fujitsu.

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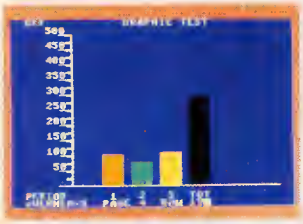

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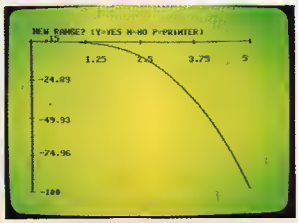

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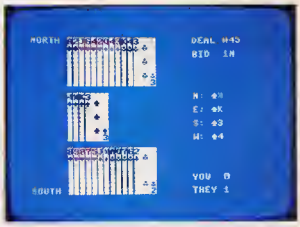

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Bundling Printers With Computers: **Did Coleco Answer A Need?**

Selby Bateman, Features Editor

Coleco made headlines late last year when it introduced the new Adam computer system, complete with a letter-quality daisy wheel printer, all for under $700.

Since that time, industry leaders and observers have waited and watched to see if Coleco's bundling was a brilliant idea whose time had come or merely a gimmick that would fail to catch on. The results, according to a number of industry leaders, have been a little bit of both.

"There's a definite trend toward bundling," says Craig Ringuette, merchandising manager for Okidata, a leading printer manufacturer. He admits, however, that he is dissatisfied with Coleco's effort.

"The Coleco printer is a 12 cps (characters per second) daisy wheel. You can almost type as fast as that. You can't print graphics. That thing has so many limitations, I don't know how anybody could be satisfied with it for any type of real computer application. You'd be spending your whole life waiting for the printer to get caught up."

Consumers Like Bundles

Despite Ringuette's assessment of the Coleco printer, he's convinced that bundling is attractive to most buyers of personal computers. "Say I'm Joe Consumer. I buy an Apple computer, and if there's an Apple printer sitting there, it's going to be a lot easier to sell me that than it is an Okidata or an Epson or anybody else.

"It may not be the wisest move you can make, but you're seeing a trend toward it," he says.

Opinions differ on the success of bundling, however. "I have not seen that to be a trend," says Rick Osgood, national technical support manager for Star Micronics. "It's something a marketing group will try, to see what the reaction is; and based on the reaction, decide to go whole hog or not. But across the industry, I have not seen that to be a large idea that has taken hold."

A Question Of Profits

"From a marketing standpoint, your peripherals are your bread and butter. You can undercut (the retail pricing) on your main system—your CPU (central processing unit). You're not as likely to bundle your add-ons: printers, modems, disk drives," Osgood says.

While some manufacturers have tried bundling in one form or another, it can create problems for dealers who sell to the public, says Ron Ockander, director of sales for Epson America, Inc. "We did a bundle last July. You could walk away with a printer and a computer, for the price of the computer. And Apple is doing it now with its ImageWriter [the printer that is a part of the Macintosh system]," he says.

"But we have to be very careful that we don't alienate the dealer. If he wants to sell a different type of bundle, he likes to have that prerogative. And if you take that away from him by forcing him to buy in bundles, it takes away some of his merchandising capability," Ockander says.

Experience Is A Factor

For many first-time computer users, a bundled system is as attractive for a computer as it is for a stereo system, notes Jim Hafer, supervisor of product evaluations for Micro D. "It's going to have its place. There are certainly people who are going to want to buy a bundled package. But the people who are really dedicated to using computers, and getting the most out of them, will buy their original accessories separately."

Market researcher Ken Bosomworth believes that bundling will be attractive to consumers in the future. "Particularly as the home user gets more into using his computer to do teleshopping and electronic banking and so forth, he's really going to want a running paper record of transactions that he's initiated.

"And I think you'll find that computer manufacturers are going to respond to this by both bundling and building in printers in many future home computers," he says. "But they will not necessarily be full 80-column printers. They may be little calculator-type strip printers."

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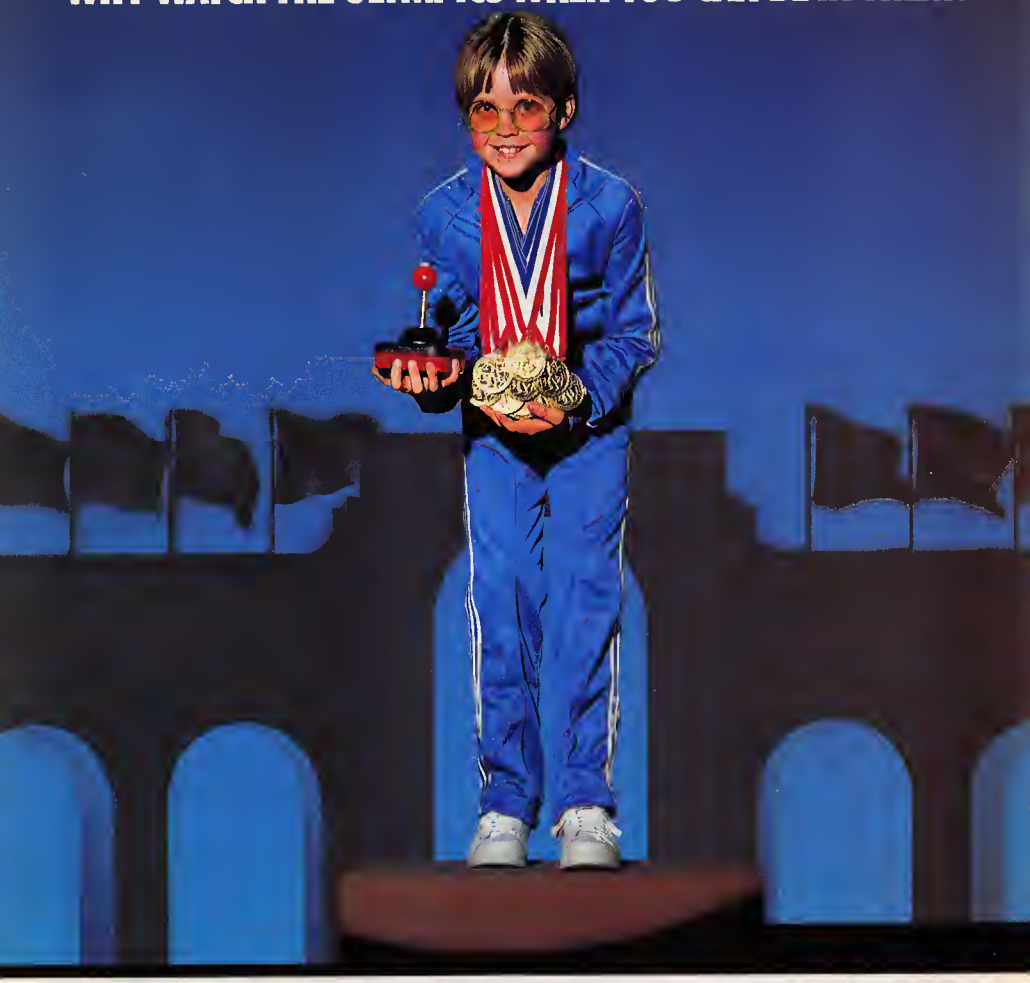

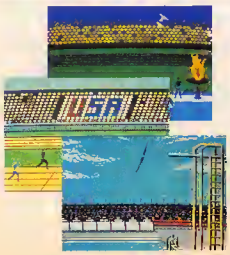

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The Inexpensive Printers Of 1984

Kathy Yakal, Editorial Assistant

Perhaps more than any other peripheral—even computers themselves—printers have made tremendous advances over the last year. Higher-quality print technology that could only be found on over-$1000 models can now be had for less than $700.

The following chart lists features of these inexpensive peripherals. We have tried to be as comprehensive as possible. If any manufacturer has been left out, we regret the omission.

Here's a brief explanation of printer specifications:

Compatibility: Perhaps the biggest stumbling block in matching a printer to your needs. Many printers will accept both parallel (Centronics) and serial (RS-232 or IEEE-488) interfaces; some even have cables for specific computers. Be sure the printer you want has the correct interface, and that you have any necessary cables or connectors.

Print Technology: The method employed to print characters on paper. In the under-$700 category, there are several: impact (dot-matrix or daisy wheel); thermal, which requires special paper; thermal transfer, which works with any kind of paper; and ink-jet, which sprays the ink on the paper through tiny holes. (For more detailed description, see Selby Bateman's article "Choosing The Right Printer" elsewhere in this issue.)

Speed: How fast the printer prints, usually noted in characters per second (cps).

Pitch: Characters per inch (cpi) or characters per line (cpl). This can vary, if the printer supports software that calls for different fonts, like italics, double-width, or compressed characters.

Logic-Seeking?: To print as quickly as possible, many printheads will move in the most economical direction, bidirectionally, and "look for" the closest character at the end of each line.

Buffer: This is another way many printers save you time. A buffer is that area of a printer that "holds" the characters next in line to be printed, freeing up the computer for further input. Most printers have very small buffers, but buffer expansion cards are available for longer printing jobs.

True Descenders?: On some printers, lowercase letters that have "tails," like j, g, and y, do not extend below the line. If you're using your printer for anything beyond casual home use, you will probably want a printer that can print true descenders.

Paper: Maximum width paper you can use with this printer. Standard printer paper for use with tractor feed printers is 9.5 inches wide. With a friction feed printer, any size paper, up to the maximum regulated by the carriage width, can be used.

Feed Type: Pin (tractor) and friction feed are the two most common found on printers for personal computers. Sprockets on the edge of the printer's platen catch the holes at the edge of the paper on tractor feed printers. Friction feed is similar to the way a typewriter holds the paper. Some printers have the option for both; if not, manufacturers often offer optional snap-on tractors.

Suggested Retail Price: List price at the time this chart was prepared. Individual retailers' prices may vary.

Most printers are capable of printing graphics, as well as additional character sets beyond the standard 96-character ASCII set.

- What print width do you want? The number of characters that a printer can put on a line varies from 32 to 40 to 80, and even up to 132. The 80-column format is a standard with 8½ x 11-inch paper for word processing, and is thus one of the most popular widths.
- Do you want to print graphics, or only text? Many dot matrix printers allow you to print an almost unlimited variety of graphic images. Daisy wheel printers, however, use preset, fully formed characters. In addition, there are printers which support high-resolution images from your screen.

There is evidence that personal computer users are becoming more interested in these graphics capabilities as the price of printers comes down. "That's because of the business market," says Micro Peripherals' Charles Srogus. "But people in the home have seen that. The consumer is looking at it and saying, 'Gee, this is fun. I'd like to do that myself.'"

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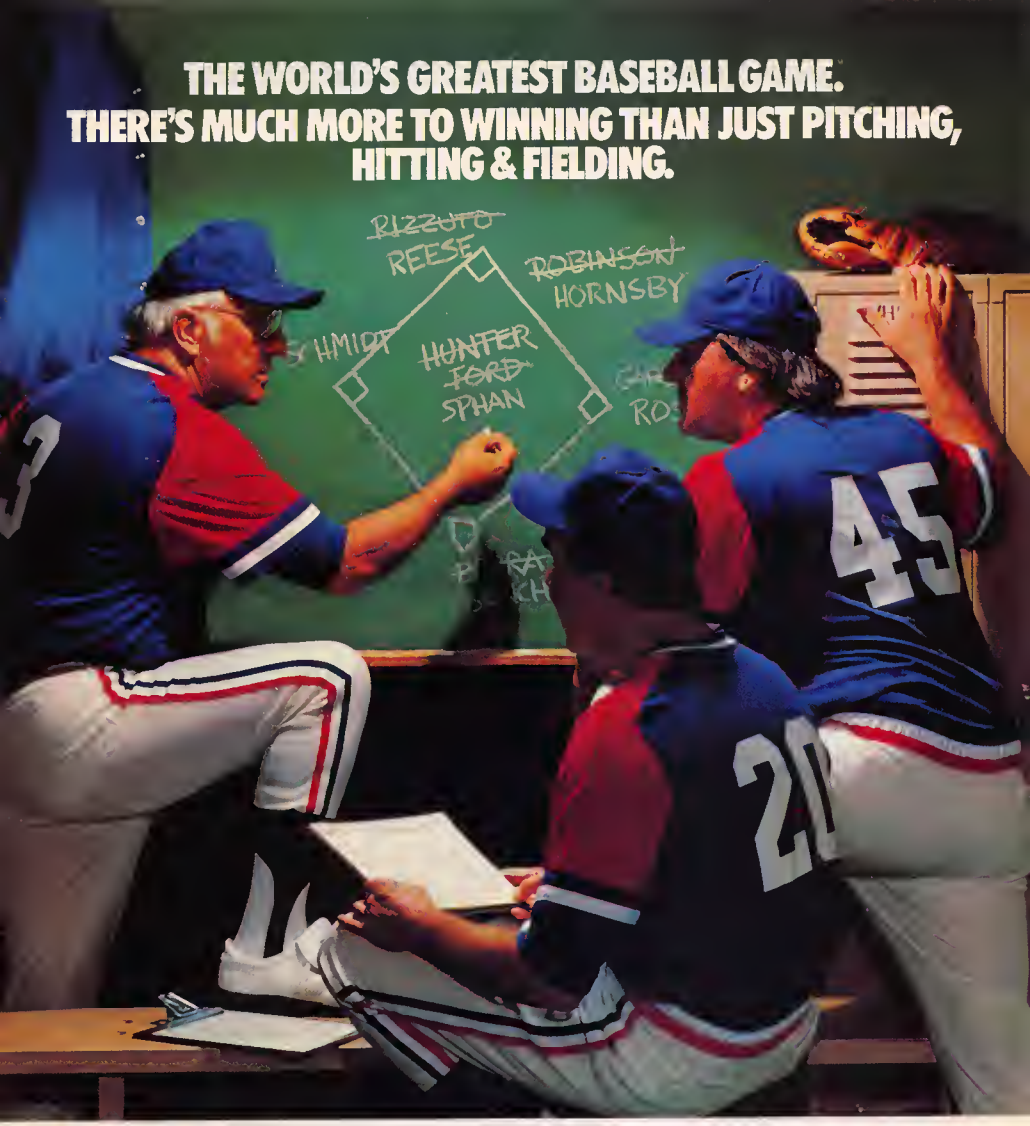

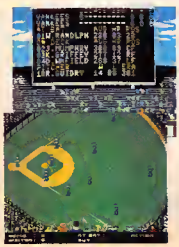

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Model Neme	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Logic-Seeking	Buffer	True Descenders	Max. Paper Width, in.	Feed Type	Suggested Retail Price	Comments
Abati LQ-20	Micro D	Parallel standard; serial optional	Impact (daisy wheel)	18 cps	120–180 cpl	Yes	1.5K	Yes	13	Friction standard; pin optional	$479	Special character sets with purchase of additional wheels
Alphacom 42	Alphacom, Inc.	Parallel and serial cables available; also Commodore, Atari, TI	Thermel	80 cps	10 cpi		One line	Yes	4.5	Friction	$119.95	Price does not include interface
Alphecom 81	Alphacom, Inc.	Parallel and serial cables available; also Commodore, Atari, TI, Apple	Thermal	80 cps	10 cpi		One line	Yes	8¾	Friction	$169.95	Price does not include interface
Cardco LQ-2	Cardco, Inc.	Parallel standard; built-in interface for Commodore computers	Impact (daisy wheel)	12–20 cps	Max. 80 cpl	Yes	80 characters	Yes	8.7	Friction	$349.95	Can run on optional battery pack
CGP-220	Tandy Corporation/Radio Shack	Parallel standard; TRS-80 Color Computer serial interface included	Ink-jet	2600 dots per second, 37 cps	12 cpi		One line	Yes	8.5	Friction only	$699	• Seven colors • Hi-res color
Compumate 2100	Swintec Corporation	Parallel and Serial	Impact (daisy wheel)	20 cps	10–15 cpi	Yes	256 characters	Yes	14	Friction and power	$649	International cheracter sets
Commodore 1526	Commodore Business Machines	Serial	Impect (dot-matrix)	45 inches per minute	80 cpl	Yes	One line	Yes	8.5	Friction and pin	under $300	
Comnter CR-II	Comrex	Parellel and seriel available	Impact (daisy wheel)	12 cps	10–15 cpl	Yes	5K	Yes	13.5	Friction standard; pin optional	$649 Serial $599 Parallel	
Delta 10	Star Micronics	Parallel and serial standard	Impact (dot-matrix)	160 cps	80–136 cpl	Yes	8K standard: expandable to 16K	Yes	9.5	Both friction and pin	$549	• International character sets • 64 special characters, 32 block shapes
DMP-120	Tandy Corporation/ Radio Shack	Parallel standard; TRS-80 Color Computer serial interface included	Impact (dot-matrix)	120 cps	10–16.7 cpl	Yes	One line	Yes	9.5	Both pin and friction	$499.95	Bit-image graphics
DMP-200	Tandy Corporation/ Radio Shack	Parallel standard; TRS-80 Color Computer serial interface included	Impact (dot-matrix)	120 cps	10–16.7 cpi	Yes	One line	Yes	9.5	Both pin and friction	$699	Correspondence fonts
Epson FX-80	Epson America, Inc.	Parallel standard; serial optional	Impact (dot-matrix)	160 cps	10–12 cpi	Yes	2K (with serial)	Yes	10	Friction and pin	$699	Internetional character set
Epson MX-80	Epson America, Inc.	Parellel standard	Impact (dot-matrix)	80 cps	80 cpl	Yes	One line	Yes	10	Friction and pin	$494	
Epson RX-100	Epson America, Inc.	Parallel standard; serial optional	Impact (dot-matrix)	100 cps	up to 136 cpl	Yes	2K (with serial)	Yes	15.5	Friction and pin	$699	• Dot-addressable graphics • International character set
Facit 4510	Facit Data Products	Both parallel and serial	Impact (dot-matrix)	120 cps	10–17 cpi	Yes	2K	Yes	11	Friction and pin standard	$495	• International character sets • Block and pin graphics
Gemini 10X	Star Micronics	Parallel standard; serial optional	Impact (dot-matrix)	120 cps	6–17 cpi	Yes	4K or 8K	Yes	9.5	Both friction and pin	$399	32 block shapes
Gemini 15X	Star Micronics	Parallel standard; serial optional	Impact (dot-matrix)	120 cps	136–232 cpl	Yes	8K standard: expandable to 16K	Yes	9.5	Both friction and pin	$549	88 international characters
GP 100–TI	Axiom Corporation	Includes cable that plugs directly into TI-99/4A	Impact (dot-matrix)	30 cps	5–10 cpi	Yes	One line		9.5	Pin	$299	
GP 700 AT	Axiom Corporation	Plugs into serial user port on Atari	Impact (dot-matrix)	30 cps	5–10 cpl	Yes	One line		9.5	Pin	$599	
IT-4010	Blue Chip Electronics	Seriel end perellel standard; no special interface required for Commodore 64	Thermel transfer	120 cps	10–15 cpi	Yes	256 bytes	Yes	9.5	Both pin and friction	$399	• International character sets • Seven colors • Will print on any paper
Image-Writer	Apple Computer	Apple II, III, LISA	Impect (dot-matrix)	120 cps	36–136 cpl	Yes	1K	Yes	10	Friction and adjustable-width pin	$675	

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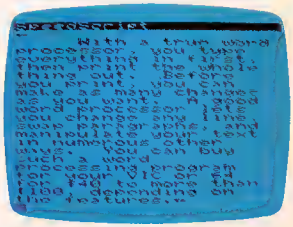
You'll profit from comprehensive reviews of everything from data-quality cassette tapes to software to graphics plotters and modems. Virtually anything that's compatible with your Commodore is reported on in *COMPUTE!'s Gazette*. With this kind of expert help, every computer purchase you make can be the right one!



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Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Logic-Seeking	Buffer	True Descenders	Max. Paper Width, in.	Feed Type	Suggested Retail Price	Comments
KX-P1090	Panasonic	Parallel: serial optional	Impact (dot-matrix)	80 cps		Yes	1K standard; 4K optional	Yes	10	Pin and friction	$399	
KX-P1091	Panasonic	Parellel standard; serial optional	Impact (dot-matrix)	120 cps		Yes	1K standard; 4K optional	Yes	10	Pin and friction	$499	
KX-P1092	Panasonic	Parallel standard; serial optional	Impact (dot-matrix)	180 cps		Yes	1K standard; 4K optional	Yes	10	Pin and friction	$599	
KX-P3151	Panasonic	Serial standard	Impact (daisy wheel)	22 cps	10–12 cpi	Yes	1K standard; 4K optional	Yes	15.5	Friction only: pin optional	Around $700	
Legend 800/1000	Legend Peripheral Products	Parallel standard; serial optional	Impact (dot-matrix)	Legend 800: 80 cps Legend 1000: 100 cps	40–142 cpi	Yes	1K	Yes	10	Friction and pin standard	800:$349 1000:$359	Eight international character sets
M120/10	Blue Chip Electronics	Serial and parallel standard; no special interface required for Commodore 64	Impact (dot-matrix)	120 cps	10–15 cpi	Yes	256 bytes	Yes	9.5	Both pin and friction	$349	
Microline 80	Okidata	Parallel standard	Impact (dot-matrix)	80 cps	80–132 cpi	No	None	Yes	9.5	Pin and friction; tractor optional	$449	
Microline 82A	Okidata	Parallel and RS-232 serial standard; IEEE488 optional	Impact (dox-matrix)	120 cps	80–132 cpi	Yes	2K (optionel with serial)	Yes	9.5	Friction and pin	$549	• 64 block shapes • Okigraph I and II dot-addressable graphics • Optional paper stand, accoustical cover
Microline 92	Okidata	Parallel and serial standard	Impact (dot-matrix)	40–160 cps	80–136 cpi	Yes	Serial comes with 2K IEEE488 2 or 4K	Yes	9.5	Friction and pin standard: tractor optional	$699	• International character sets • Optional paper stand, accoustical cover
Microprism	Integral Data Systems	Parallel and serial	Impact (dot-matrix)	75–110 cps	10–16.8 cpi	Yes	1.2K	Yes	8.5	Pin and friction	$649	
MPS-801	Commodore Business Machines	Serial	Impact (dot-matrix)	50 cps	80 cpi	No	One line	No	8.5	Pin	under $300	Second serial port on back
NEC PC-6021	NEC Home Electronics (USA), Inc.	Parallel standard	Thermal	40 cps	40 cpi	No	None	No	4.5	Friction	$249.95	
NEC PC-8023A	NEC Home Electronics (USA), Inc.	Parallel standard; serial optional	Impact (dot-matrix)	100 cps	80–136 cpi	Yes	2K	Yes	10	Both pin and friction	$499	Greek character set
Printelex	Computer Peripherals	Parallel and serial standard: interface cables available for Commodore, IBM PC, Radio Shack	Impact (dot-matrix)	160 cps	40 cpi	No	One line	No	4¼	Friction only	$145	40-column
PrintMate 99	Micro-Peripherals, Inc.	Both parallel and serial	Impact (dot-matrix)	100 cps	5–17 cpi	Yes	1K standard; expandable to 2K	Yes	9.5	Friction and pin standard	$599	
Prowriter 8510-AP	C. Itoh	Parellel and serial available	Impact (dot-matrix)	120 cps	10–17 cpi, 80–136 cpi	Yes	1K	Yes	13	Both friction and pin	Parallel: $495. serial: $755	Five additional character sets
Sprinter	Micro-Peripherals, Inc.	Parallel standard: serial optional	Impact (dot-matrix)	160 cps	10–17 cpi	Yes	4K	Yes	9.5	Friction and tractor standard	$695	• Three selectable foreign fonts • Portable • Buffer expandable to 68K through Memory Mate • Built-in single sheet feed
Seikosha GP-100A	Axiom Corporation	Axiom Corporation	Impact (dot-matrix)	64 cps	32 cpi	No	None		10		$389	
Seikosha GP-250X	Axiom Corporation	Parallel and serial available	Impact (dot-matrix)	50 cps	80 cpi	No	80 bytes		10		$499	

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Model Name	Manufacturer/ Distributor	Compatibility	Print Technology	Speed	Pitch	Logic-Seeking	Buffer	True Descenders	Max. Paper Width, in.	Feed Type	Suggested Retail Price	Comments
Think-Print 80	Axonix Corporation	Parallel and serial available	Thermal	40 cps	80–136 cpl	Yes	2K	No	8.5	Friction feed	$279	• Portable • Battery-operated • AC adapter included
Transtar 120	Silver Reed	Parallel and serial versions available	Impact (daisy wheel)	14 cps	10,12,15 cpi	Yes	2K serial, none on parallel	Yes	13	Friction standard; pin optional	$550	Portable
Transtar 130	Silver Reed	Parallel and serial versions available	Impact (daisy wheel)	18–20 cps	10–12 cpi; also supports proportional spacing	Yes	None on parallel; 2K on serial	Yes	17	Friction standard; pin optional	$599	
Transtar 315	Seikosha	Parallel standard; serial optional	Impact (dot-matrix)	38–50 cps	10–13.3 cpi	No	Serial: 2K standard; additional 2K optional. None on parallel	No	11	Both friction and pin	$599	Prints seven colors, more than 30 shades
TRS-80 DMP-110	Tandy Corporation/Radio Shack	Parallel standard; TRS-80 Color Computer serial interface included	Impact (dot-matrix)	120 cps	10–16.7 cpi	Yes	One line	Yes	9.5	Pin and friction	$499.95	• 32 international characters • Bit-image graphics
TTP16	Fujitsu America, Inc.	Parallel and serial available	Thermal transfer	45 cps	80–96 cpl	No	None	Yes	10	Friction	$625	• Single-sheet feeding • Four separate color ribbons • No special paper required
ThinkJet (HP2225)	Hewlett-Packard	Parallel. HP-1B, and HP-IL available	Ink-jet	150 cps	40–142 cpl	Yes	1000 bytes	Yes	9.5	Pin and friction	$495	• Portable • No special paper required • International character sets

Many More Options

● What special print capabilities do you need for text? Many printers today give you the option of printing elongated type, condensed characters, underlined text, subscripts and superscripts, boldface and italic type, and other special forms. Some printers will also let you print different typefaces in a variety of sizes.

● What kind of paper do you want with your printer? There are tractor-feed printers which precisely advance paper by using teeth that fit into holes on both sides of the paper. The teeth pull the paper through the printer in one continuous feed. But the paper can later be separated into standard sheets. Friction-feed printers operate much like a typewriter, pulling the paper around a cylindrical platen. Friction-fed paper can slip out of alignment more easily than tractor-fed, however.

The ThinkJet Printer by Hewlett-Packard (HP 2225) is a $495 ink jet printer which uses an ink cartridge system and is fully portable.

● How much noise can you tolerate? Daisy wheel and dot matrix impact printers can produce quite a bit of noise, something you might also need to consider.

Once you've answered all of these questions, then you're ready to shop around and find the printer that does the best job for your computer.

A printer is so important for most computer users that Okidata's Ringuette sometimes gets the feeling that the purchase of a computer and then a printer is putting the cart before the horse. "You really ought to buy the printer first. Most people buy the thing backwards," he says, not quite tongue in cheek. "Basically, a computer is only worth the paper it's printed on."

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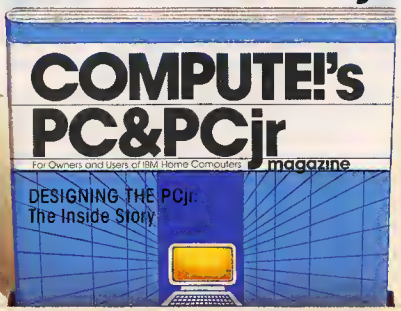

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Major Printer Manufacturers And Distributors

If you are interested in finding out more about a particular printer, it's best to check with a local computer dealer first. If they don't have the information you need, contact the manufacturer or distributor listed here.

Alphacom, Inc.
2323 S. Bascom Ave.
Campbell, CA 95008

Apple Computer
20525 Mariani Ave.
Cupertino, CA 95014

Axiom Corporation
1014 Griswold Ave.
San Fernando, CA 91340

Axonix Corporation
417 Wakara Way
Salt Lake City, UT 84108

Blue Chip Electronics
7406 E. Butherus Dr.
Scottsdale, AZ 85260

CAL-ABCO
Legend Peripheral Products
14722 Oxnard St.
Van Nuys, CA 91401

Cardco, Inc.
300 S. Topeka
Wichita, KS 67202

Commodore Business Machines
1200 Wilson Dr.
West Chester, PA 19380

Computer Peripherals
6400 Canoga Ave.
Suite 305
Woodland Hills, CA 91367

Comrex
3701 Skypark Dr.
Torrance, CA 90505

Epson America, Inc.
3415 Kashiwa St.
Torrance, CA 90505

Facit Data Products
235 Main Dunstable Rd.
Nashua, NH 03060

Fujitsu America, Inc.
3055 Orchard Rd.
San Jose, CA 95134

Hewlett-Packard
3000 Hanover St.
Palo Alto, CA 94304

Integral Data Systems
Milford, NH 03055

Leading Edge
225 Turnpike St.
Canton, MA 02021

Micro Peripherals, Inc.
4426 S. Century Dr.
Salt Lake City, UT 84123

NEC Home Electronics (U.S.A.), Inc.
Personal Computer Division
Elk Grove Village, IL 60007

Okidata
Mt. Laurel, NJ 08054

Panasonic Company
One Panasonic Way
Secaucus, NJ 07094

Star Micronics
200 Park Ave.
Pan Am Building
New York, NY 10166

Swintec Corporation
23 Poplar St.
P.O. Box 421
East Rutherford, NJ 07073

Tandy Corporation/Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102

Transtar
P.O. Box C-90975
Bellevue, WA 98009

Avoiding Printer Problems

J. Blake Lambert, Assistant Editor

When you first bring your new printer home—before you connect it to anything—you should read through the manual. And if you have an add-on interface, read its manual, too. If you just pull everything out, try holes till the plugs fit (or bend), plug everything in and say, "I command thee: PRINT," it probably won't work. You may get a few things to work this way, but you're likely to run into problems.

Don't Force Connections

After looking through the manual, follow the recommendations for connecting the printer to the interface (if necessary) and computer. Don't force connections together. The connections should be snug, but if the parts don't fit, check the diagrams and text to make sure you are doing everything right.

You may need to install the print ribbon, and check the print head (or insert a daisy wheel, on letter-quality printers). Check the manual for instructions, and check on the printer for stickers with diagrams and instructions that may have been left out of the manual.

Before you turn the system on, check the printer manual to see the correct setting for the DIP (Dual In-line Package) switches. These allow you to select the functions that the printer will default to—the normal settings. Some interfaces also have internal DIP switches which you need to set to get the best results. See the interface manual to find the correct switch positions for your system.

Sometimes just feeding the paper through the printer causes problems. Most of these are easily cured. When using continuous pin-feed paper, make sure the paper is not in a bind anywhere on its way to the printer. If your printer allows for both regular and pin-feed paper, be sure the platen is set for the correct mode. If the platen is holding the paper while the tractor mechanism is trying to pull the paper through, this can cause the paper to jam.

The first time you print something, don't be shocked if the printer puts everything on one line, or if you get double-spacing when you expected single. This is usually not a problem with the printer. Instead, it can mean that the DIP switches are still not set correctly, or that you are using the incorrect interface mode. Experiment with the interface modes; you can't hurt anything, and you may discover some features you didn't know about. ©

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Twist tabs on the back of the center panel allow for neat concealed grouping of wires while a convenient storage shelf for books or other items lies below.
The printer sits behind a fold down door that provides a work surface for papers or books while using the keyboard. The lift up top allows easy access to the top and rear of the printer. A slot in the printer shelf allows for center as well as rear feed printers.
Behind the lower door are a top shelf for paper, feeding the printer, and a bottom shelf to receive printer copy as well as additional storage.
Stand fits same computers as the CS-1632 as well as the Apple I and II, IBM-PC, Franklin and many others.
The cabinet dimensions overall: 39-1/2" high x 49" wide x 27" deep.
Keyboard shelf 20" deep x 26" wide. Disk drive shelf 15-34" deep x 26" wide. Top shelf for monitor 17" deep x 27" wide. Printer shelf 22" deep x 19" wide.

HYTEC SYSTEMS

Pests

Kevin Woram

Poor Joe. Weeds and blight are choking and wilting his flowers. Use a joystick to help him save his blossoms from oblivion. Originally written for the Commodore 64, versions are included for VIC-20, IBM PC, and PCjr.

Ever since man cleared his first plot of ground and planted a few seeds, he has fought an endless battle with the enemies of his garden, the dreaded weeds. Now, you can join the agrarian struggle, and you won't even have to get your hands dirty.

Using a joystick plugged into port 2, you can guide Joe the gardener as he races around, spraying weeds where they appear and fumigating his flowers against another deadly enemy, disease. Joe not only has weeds and disease to contend with, but he also must keep track of time. If he spends too much time killing weeds and spraying flowers, the timer will run down and disease will overrun his garden.

If Joe manages to overcome all these obstacles, he will advance to the next level of difficulty where more flowers and nastier weeds await him. When Joe completes a level, the amount of time remaining on the clock is awarded to him in the form of bonus points.

A Two-Minute Flower Show

At the beginning of each game, Joe has two minutes to complete the level, but with each successive level he gets 15 extra seconds to finish his work. There are three kinds of flowers in Joe's garden—yellow daisies, blue daisies, and red roses. They all must be fumigated to complete a level, but Joe doesn't have to kill all the weeds on a level.

All it takes to fumigate a flower is to position Joe's spray gun so that it points to a flower, then press the joystick button. Flowers which have been fumigated turn white. The process is the same for weeds, but Joe's spray is a deadly poison to weeds, bringing instant disintegration.

Joe gets 10 points for fumigating yellow daisies, 20 points for blue daisies, and 40 points for roses. Killed weeds are worth five points.

The Life Cycle Of Weeds

Weeds grow in three stages. They start off as seeds, grow to sprouts, and then become adults. In the adult stage, they multiply rapidly by spreading seeds which grow to adulthood and then repeat the process. If too many weeds are allowed to grow in the garden, the game ends and a TOO MANY WEEDS message appears on the screen.

Likewise, if time runs out, the game will end and a TIME'S UP message will appear.

The highest score will be kept and displayed by the computer between games. Playing "Pests" takes a quick mind and a fast trigger finger, so if you've ever wondered if you have a green thumb, here is your chance to find out.

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1984/128pp/paper/ISBN 0-89303-333-2/$12.95

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In this volume the master teacher has taken a hands-on approach to BASIC language and practical real-life applications. The book gives a complete and up-to-date account of what the Commodore 64 is and how it works. Page by page, the reader is introduced to DOS and BASIC. It shows how to program for personal and professional needs and includes programs for mailing lists, word processing, telephone lists, graphics, sound, and file handling—plus extensive coverage on structuring, planning, and debugging programs.
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ADVANCED BASIC PROGRAMMING FOR THE COMMODORE 64 AND OTHER COMMODORE COMPUTERS
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This is the next step for the Commodore user who has mastered the basics and wants to move on to more advanced software. In this book, the reader will learn how good programs are written, how to read and use them, how to know a good one when they see it, and how to gain knowledge through the experience of writing advanced software.
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COMMODORE 64: GETTING THE MOST FROM IT
Tim Onosko

Written for users with little or no previous programming experience, this handy guide is the only source with information on all three versions of the Commodore 64. It includes material on both the classroom model and the portable version. It offers a thorough and understandable introduction to the computer—including a solid approach to BASIC programming. It covers word processing, color graphics, and sound.
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BRADY

In this 64 version of "Pests," the player tries to fertilize the flowers.

The player scrambles to kill weeds before they overrun the screen (VIC version of "Pests").

If you want to save yourself the trouble of typing the Commodore 64 version of this program, send a stamped, self-addressed envelope, a blank cassette or diskette (1541 format), and $3 to the address listed below, and I will make a copy (64 version *only*) for you.

Kevin Woram
4314 Killarmet
Corpus Christi, TX 78413

Program 1: Pests For Commodore 64

Refer to the "Automotic Proofreoder" orticle before typing this program in.

```
10 POKE53280,0:POKE53281,0:GOTO1000
                                        :rem 234
15 CO=54272:JL=56320:TR=16:N=15         :rem 245
20 GOSUB10000:GOSUB6000:DIMPP(200),JP(15)
   ,CS(15),DN$(15)                      :rem 121
23 SC=0:D=15:E=3:QW=E:ET=200:WL=20:LV=1:D
   N$="{HOME}{12 DOWN}"                 :rem 148
25 RS=439:AV=1104:U=40:B=32:FC=7:FI=0:GOS
   UB3000:TI$="000000"                  :rem 145
31 PRINT"{CLR}{WHT} SCORE:";SC:PRINT"
   {HOME}"TAB(15)"LEVEL:";LV:PRINT"{HOME}
   "TAB(28)"TIME:";TI$                  :rem 44
32 POKE1064+CO,5:POKE1064,85:FORK=1065TO1
   102:POKEK+CO,5:POKEK,67:NEXT         :rem 190
33 POKE1103+CO,5:POKE1103,73            :rem 60
34 FORK=1104TO1944STEP40:POKEK+CO,5:POKEK
   ,66:POKEK+CO+39,5:POKEK+39,66:NEXT
                                        :rem 148
35 POKE1984+CO,5:POKE1984,74:FORK=1985TO2
   022:POKEK+CO,5:POKEK,67:NEXT         :rem 226
36 POKE2023+CO,5:POKE2023,75:PL=191:QF=0
                                        :rem 49
39 FORK=1TO3:FORJ=1TOD                  :rem 162
40 FP=(INT(RND(1)*RS)*2)+AV:SP=FP+U
                                        :rem 71
50 IFPEEK(FP)<>BTHEN40                  :rem 79
55 IFPEEK(SP)<>BTHEN40                  :rem 97
60 POKEFP+CO,FC:POKEFP,PL:POKESP+CO,5:POK
   ESP,207:QF=QF+1:NEXT:D=D-10          :rem 102
70 IFFC=7THENFC=3:PL=192:GOTO90         :rem 166
80 FC=2:PL=193                          :rem 16
90 NEXT:D=D+30:OP=1105:POKEOP,196:WC=203:
   X=0:GOSUB300:TI$="000000":GOTO110
                                        :rem 121
100 IFH<0THENH=0                        :rem 184
101 IFE<0THENE=0                        :rem 179
103 IFWC=206THENWC=203:X=X+E:GOSUB300:GOT
    O110                                :rem 22
105 GOSUB320                            :rem 171
110 L=TI+500:GOTO4000                   :rem 175
300 FORH=XTOX+E                         :rem 194
305 WP=INT(RND(1)*(RS*2))+AV:IFPEEK(WP)<>
    BTHEN305                            :rem 197
310 PP(H)=WP:POKEPP(H)+CO,9:POKEPP(H),WC:
    NEXT:E=E+1:IFH>WLTHEN8000           :rem 156

315 RETURN                              :rem 121
320 FORH=XTOX+E:POKEPP(H)+CO,9:POKEPP(H),
    WC:NEXT:RETURN                      :rem 131
1000 REM CHR. SET LOADER                :rem 83
1010 PRINT"{CLR}{WHT}LOADING CHARACTER SE
     T INTO MEMORY...":PRINTCHR$(142)
                                        :rem 239
1020 POKE52,48:POKE56,48:CLR:Z=56334
                                        :rem 78
1030 POKEZ,PEEK(Z)AND254                :rem 183
1040 POKE1,PEEK(1)AND251                :rem 99
1045 IFPEEK(13950)=24THEN1060           :rem 106
1050 FORI=0TO2047:POKEI+12288,PEEK(I+5324
     8):NEXT                            :rem 74
1060 POKE1,PEEK(1)OR4                   :rem 207
1070 POKEZ,PEEK(Z)OR1                   :rem 31
1080 POKE53272,(PEEK(53272)AND240)+12:BC=
     13816                              :rem 231
1090 FORK=1TO4:FORNM=BCTOBC+7:READCD:POKE
     NM,CD:NEXT:RESTORE:BC=BC+8:NEXT
                                        :rem 17
1095 BC=BC-8:FORNM=BCTOBC+111:READCD:POKE
     NM,CD:NEXT:GOTO15                  :rem 197
2000 DATA0,0,0,0,24,126,231,60          :rem 203
2010 DATA24,60,66,153,189,255,126,60
                                        :rem 31
2020 DATA60,126,255,189,153,66,60,24
                                        :rem 32
2030 DATA28,38,79,223,223,79,38,28
                                        :rem 203
2040 DATA192,252,70,95,95,127,62,28
                                        :rem 248
2050 DATA28,62,127,95,95,70,252,192
                                        :rem 249
```

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```
2070 DATA56,100,242,251,251,242,100,56
                                    :rem 111
2080 DATA3,63,98,250,250,254,124,56
                                    :rem 240
2090 DATA56,124,254,250,250,98,63,3
                                    :rem 241
2100 DATA0,0,24,24,24,0,0,0         :rem 51
2110 DATA0,34,28,8,28,34,0,0        :rem 124
2120 DATA66,231,126,60,36,126,231,66
                                    :rem 24
2130 DATA153,60,90,255,255,90,60,153
                                    :rem 28
2140 DATA24,24,153,219,126,60,24,0
                                    :rem 171
3000 REM JOYSTICK INITIALIZER       :rem 91
3010 JP(0)=0:JP(1)=-40:JP(2)=40:JP(4)=-1:
     JP(5)=-41                      :rem 133
3020 JP(6)=39:JP(8)=1:JP(9)=-39:JP(10)=41
     :DO=191                        :rem 91
3040 CS(0)=195:CS(1)=195:CS(2)=196:CS(4)=
     197:CS(5)=198                  :rem 128
3050 CS(6)=199:CS(8)=200:CS(9)=201:CS(10)
     =202:RETURN                    :rem 132
4000 JV=N-(PEEK(JL)ANDN):FR=PEEK(JL)ANDTR
     :CS(0)=CS(JV)                  :rem 67
4005 IFFR<>TRTHENGOSUB5500          :rem 137
4010 NP=OP+JP(JV):IFPEEK(NP)<>BTHENNP=OP
                                    :rem 55
4015 POKENP+CO,15:POKEOP,B:POKENP,CS(JV):
     OP=NP                          :rem 202
4020 IFTI>LTHENWC=WC+1:GOTO100      :rem 124
4025 PRINT"{HOME}"TAB(33)TI$:IFVAL(TI$)>E
     TTHEN8100                      :rem 139
4030 GOTO4000                       :rem 196
5500 MP=CS(JV):GOSUB5800            :rem 178
5505 G=NP+CP:CM=G+CO:TP=PEEK(G):IFTP<128A
     NDTP>32THENRETURN              :rem 255
5510 POKECM,11:POKEG,206            :rem 140
5515 FORSN=1TO2:POKES,200:POKES+1,100:FOR
     J=1TO50:NEXT                   :rem 68
5516 POKES,0:POKES+1,0:FORH=1TO50:NEXT:NE
     XT                             :rem 244
5517 IFTP=207THENPOKECM,5:POKEG,207:RETUR
     N                              :rem 185
5519 IFTP=194THENPOKECM,1:POKEG,194:RETUR
     N                              :rem 193
5520 IFTP=BTHENPOKEG,B:RETURN       :rem 171
5530 IFTP=191THENSC=SC+10:GOTO5900:rem 61
5540 IFTP=192THENSC=SC+20:GOTO5900:rem 64
5550 IFTP=193THENSC=SC+40:GOTO5900:rem 6B
5560 SC=SC+5:E=E-1:POKEG,B:PRINT"{HOME}
     {7 RIGHT}";SC:RETURN           :rem 234
5800 IFMP=195THENCP=-40:RETURN      :rem 127
5810 IFMP=196THENCP=40:RETURN       :rem 84
5820 IFMP=197THENCP=-1:RETURN       :rem 80
5B30 IFMP=198THENCP=-41:RETURN      :rem 134
5B40 IFMP=199THENCP=39:RETURN       :rem 98
5850 IFMP=200THENCP=1:RETURN        :rem 23
5860 IFMP=201THENCP=-39:RETURN      :rem 129
5870 CP=41:RETURN                   :rem 35
5900 POKECM,1:POKEG,194:PRINT"{HOME}
     {7 RIGHT}";SC                  :rem 30
5905 FI=FI+1:IFFI=QFTHEN7000        :rem 172
5907 RETURN                         :rem 1B1
6000 REM SOUND INITIALIZATION       :rem 91
6010 S=54272:FORQ=STOS+24:POKEQ,0:NEXT
                                    :rem 115
6020 POKES+24,15:POKES+5,66:POKES+6,20:PO
     KES+4,129:RETURN               :rem 201
7000 PRINTDN$TAB(11)"LEVEL";LV;"COMPLETED
     ":TL=ET-VAL(TI$)               :rem 27
7005 PRINTTAB(12)"TIME BONUS:";TL:rem 243
7010 SC=SC+TL:LV=LV+1:D=D+4:QW=QW+1:E=QW:
     ET=ET+14:WL=WL+1               :rem 74
7020 IFD>70THEND=70                 :rem 88
7030 IFET>500THENET=500             :rem 95
7035 IFQW>20THENQW=20               :rem 2B
7037 IFWL>40THENWL=40               :rem 24
7040 FORK=1TO999:NEXT:GOTO25        :rem 12
8000 PRINTDN$TAB(13)"TOO MANY WEEDS!":GOT
     O9000                          :rem 215
8100 PRINTDN$TAB(15)"TIME'S UP!":GOTO9000
     {34 SPACES}"                   :rem 171
9000 IFSC>HSTHENHS=SC               :rem 100
9004 FORJ=1TO999:NEXT               :rem 51
9005 PRINT"{CLR}"TAB(12)"HIGH SCORE:";HS
                                    :rem 173
9008 PRINTTAB(10)"{DOWN}YOUR SCORE WAS";S
     C:PRINTTAB(10)"{DOWN}YOU ACHIEVED LE
     VEL";LV                        :rem 243
9010 PRINTDN$"{9 DOWN}"TAB(6)"PRESS TRIGG
     ER TO PLAY AGAIN"              :rem 102
9020 M=PEEK(JL)ANDTR:IFM=0THEN23    :rem 241
9030 GOTO9020                       :rem 208
10000 REM TITLE SCREEN              :rem 23
10010 PRINT"{CLR}"TAB(16)"PESTS{3 DOWN}"
                                    :rem 235
10015 PRINT"{4 SPACES}USE A JOYSTICK TO M
     OVE JOE ( ), THE{DOWN}"        :rem 141
10020 POKE1216+CO,15:POKE1216,195   :rem 57
10030 PRINT"GARDENER, AROUND THE GARDEN.
     {2 SPACES}SPRAY THE{DOWN}"     :rem 67
10040 PRINT"WEEDS ( ) USING THE TRIGGER.
     {2 SPACES}ALSO USE{DOWN}"      :rem 101
10045 POKE1351+CO,9:POKE1351,206    :rem 12
10050 PRINT"THE TRIGGER TO FUMIGATE THE F
     LOWERS.{2 DOWN}"               :rem 4
10060 PRINTTAB(11)"** SCORING TABLE **
     {DOWN}"                        :rem 136
10070 PRINTTAB(10)"WEED"SPC(11)"5 POINTS
     {DOWN}":POKE1643+CO,9:POKE1643,206
                                    :rem 203
10080 PRINT"{2 SPACES}YELLOW DAISY"SPC(11
     )"10 POINTS{DOWN}"             :rem 76
10090 POKE1683+CO,7:POKE1683,191:POKE1723
     +CO,5:POKE1723,207             :rem 108
10100 PRINT"{4 SPACES}BLUE DAISY"SPC(11)"
     20 POINTS{DOWN}"               :rem 146
10105 POKE1763+CO,3:POKE1763,191:POKE1803
     +CO,5:POKE1803,207             :rem 97
10110 PRINTTAB(10)"ROSE"SPC(11)"40 POINTS
     {DOWN}"                        :rem 181
10115 POKE1843+CO,2:POKE1843,191:POKE1883
     +CO,5:POKE1883,207             :rem 111
10120 PRINTTAB(9)"PRESS TRIGGER TO BEGIN"
                                    :rem 207
10130 M=PEEK(JL)ANDTR:IFM=0THENRETURN
                                    :rem 150
10140 GOTO10130                     :rem 36
```

Program 2: Pests For VIC

Refer to the "Automatic Proofreader" article before typing this program in.

```
10 POKE36879,8:GOTO1000             :rem 57
15 POKE36878,15:POKE36869,253:CO=30720
                                    :rem 123
20 DIMPP(200),JP(15),CS(15),DN$(15)
                                    :rem 78
23 SC=0:D=10:E=3:QW=E:ET=200:WL=20:LV=1:D
   N$="{HOME}{11 DOWN}"             :rem 126
```

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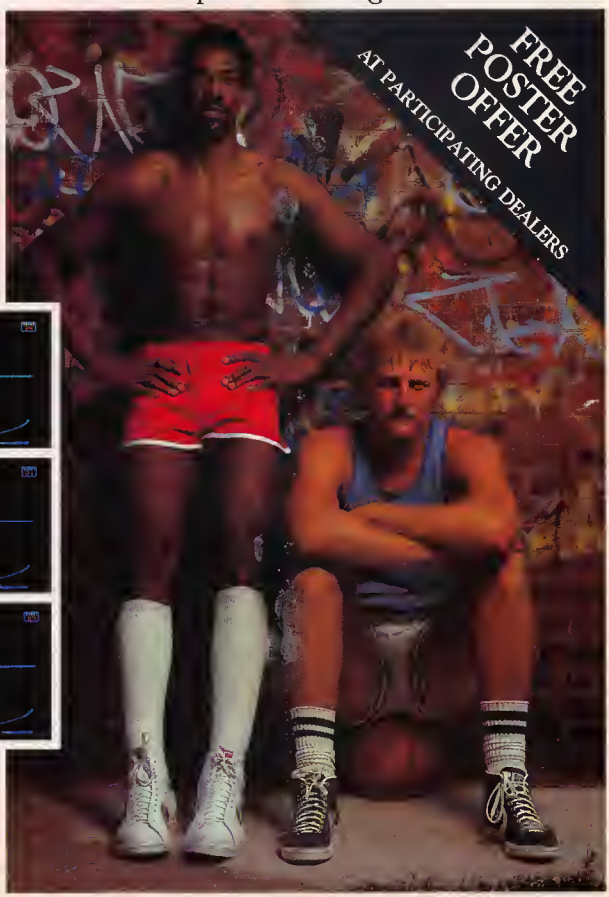

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ELECTRONIC ARTS™

Notes For VIC, PC, And PCjr

Kevin Martin, Editorial Programmer

In "Pests," you are the gardener and you must protect the flowers from deadly weeds and disease. Protect the flowers from disease by fumigating them with a special spray. When you spray the flowers, you receive points—10 for yellow flowers, 20 for blue, 40 for red—and the flowers turn white. Destroy the weeds which grow in the garden by spraying them with the same sprayer. If you allow too many weeds to grow in the garden or your time runs out, the game ends. If you finish before the time runs out, you receive bonus points for the extra time.

The VIC version of Pests requires an 8K expander and a joystick. To RUN, first type in the program and save it to tape or disk. Then, turn the computer off and back on to reset the BASIC pointers. Next, enter the following POKEs to move screen memory and the top of BASIC:

```
POKE 43,1:POKE 44,32:POKE 8192,0:NEW
```

```
POKE 36869,240:POKE 36866,150:POKE 648,30:
PRINT"{CLR}"
```

The screen should momentarily display a flash of garbage before clearing. You now can load the program and run it as you normally would.

The PC version requires disk BASIC and the Color/Graphics Adapter board. This version will also run on a PCjr with Cartridge BASIC and disk. On the PC, you control your gardener (represented by a smiling face character) with the numeric keypad. On the PCjr, use the arrow keys at the right of the keyboard to control the gardener.

```
25 RS=219:AV=7724:U=22:B=32:FC=7:PI=0:GOS
   UB3000:TI$="000000"                :rem 155
31 PRINT"{CLR}{WHT} SCORE";SC:PRINT"
   {HOME}"TAB(13)"TIME ";RIGHT$(TI$,3)
                                      :rem 133
32 PRINT"{HOME}{DOWN}{BLU}U**************
   ******I";                          :rem 82
33 FORK=1TO20:PRINT"_{20 SPACES}_";:NEXT
                                      :rem 132
34 PRINT"J******************{WHT}";:POK
   EB1B5,75:POKE8185+CO,6             :rem 119
36 PL=191:QF=0                        :rem 27
39 FORK=1TO3:FORJ=1TOD                :rem 162
40 FP=(INT(RND(1)*RS)*2)+AV:SP=FP+U
                                      :rem 71
50 IFPEEK(FP)<>BTHEN40                :rem 79
55 IFPEEK(SP)<>BTHEN40                :rem 97
60 POKEFP+CO,FC:POKEFP,PL:POKESP+CO,5:POK
   ESP,207:QF=QF+1:NEXT:D=D-10        :rem 102
70 IFFC=7THENFC=3:PL=192:GOTO90       :rem 166
80 FC=2:PL=193                        :rem 16
90 NEXT:D=D+30:OP=7725:NP=OP:POKEOP,196:W
   C=203:X=0:GOSUB300:TI$="000000":GOTO11
   0                                  :rem 59
100 IFH<0THENH=0                      :rem 184
101 IFE<0THENE=0                      :rem 179
103 IFWC=206THENWC=203:X=X+E:GOSUB300:GOT
    O110                              :rem 22
105 GOSUB320                          :rem 171
110 L=TI+500:GOTO4000                 :rem 175
300 FORH=XTOX+E                       :rem 194
305 WP=INT(RND(1)*(RS*2))+AV:IFPEEK(WP)<>
    BTHEN305                          :rem 197
310 PP(H)=WP:POKEPP(H)+CO,4:POKEPP(H),WC:
    NEXT:E=E+1:IFH>WLTHEN8000         :rem 151
315 RETURN                            :rem 121
320 FORH=XTOX+E:POKEPP(H)+CO,4:POKEPP(H),
    WC:NEXT:RETURN                    :rem 126
1000 REM CHR. SET LOADER              :rem 83
1005 IFPEEK(6782)=24THEN15            :rem 218
1010 PRINT"{CLR}{WHT}{6 SPACES}REDEFINING
     {12 SPACES}CHARACTERS            :rem 196
1020 FORI=5120TO7168:POKEI,PEEK(I+27648):
     NEXT                             :rem 189
1030 POKE36869,253:BC=6648            :rem 157
1090 FORK=1TO4:FORNM=BCTOBC+7:READCD:POKE
     NM,CD:NEXT:RESTORE:BC=BC+8:NEXT
                                      :rem 17
1095 BC=BC-8:FORNM=BCTOBC+111:READCD:POKE
     NM,CD:NEXT:GOTO15                :rem 197
2000 DATA0,0,0,0,24,126,231,60        :rem 203
2010 DATA24,60,66,153,189,255,126,60
                                      :rem 31
2020 DATA60,126,255,189,153,66,60,24
                                      :rem 32
2030 DATA28,38,79,223,223,79,38,28
                                      :rem 203
2040 DATA192,252,70,95,95,127,62,28
                                      :rem 248
2050 DATA28,62,127,95,95,70,252,192
                                      :rem 249
2070 DATA56,100,242,251,251,242,100,56
                                      :rem 111
2080 DATA3,63,98,250,250,254,124,56
                                      :rem 240
2090 DATA56,124,254,250,250,98,63,3
                                      :rem 241
2100 DATA0,0,24,24,24,0,0,0           :rem 51
2110 DATA0,34,28,8,28,34,0,0          :rem 124
2120 DATA66,231,126,60,36,126,231,66
                                      :rem 24
2130 DATA153,60,90,255,255,90,60,153
                                      :rem 28
2140 DATA24,24,153,219,126,60,24,0
                                      :rem 171
3000 REM JOYSTICK INITIALIZER         :rem 91
3010 JP(7)=0:JP(6)=-22:JP(5)=22:JP(3)=-1:
     JP(2)=-23                        :rem 144
3020 JP(1)=21:JP(11)=1:JP(12)=-21:JP(13)=
     23:DO=191                        :rem 155
3040 CS(7)=195:CS(6)=195:CS(5)=196:CS(3)=
     197:CS(2)=198:CS(0)=195          :rem 184
3050 CS(1)=199:CS(11)=200:CS(12)=201:CS(1
     3)=202:RETURN                    :rem 214
4000 POKE37154,127:JV=(PEEK(37137)AND28)O
     R(PEEK(37152)AND128):JV=ABS((JV-100)
     /4)-7                            :rem 105
4001 IFJV=7THENJV=0                   :rem 164
```

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```
4002 FR=-(PEEK(37137)AND32)/32:CS(0)=CS(J
     V)                              :rem 117
4003 POKE37154,255                   :rem 194
4005 IFNOTFRTHENGOSUB5500            :rem 90
4010 NP=OP+JP(JV):IFPEEK(NP)<>BTHENNP=OP
                                     :rem 55
4015 POKENP+CO,1:POKEOP,8:POKENP,CS(JV):O
     P=NP                            :rem 149
4020 IFTI>LTHENWC=WC+1:GOTO1000      :rem 124
4025 PRINT"{HOME}"TAB(18)RIGHT$(TI$,3):IF
     VAL(TI$)>ETTHEN8100             :rem 224
4030 GOTO4000                        :rem 196
5500 MP=CS(JV):GOSUB5800             :rem 178
5505 G=NP+CP:CM=G+CO:TP=PEEK(G):IFTP<128A
     NDTP>32THENRETURN               :rem 255
5510 POKECM,1:POKEG,206              :rem 91
5515 FORQ1=1TO2:POKE36877,230        :rem 181
5516 FORQ2=1TO50:NEXT:POKE36877,0:FORQ2=1
     TO50:NEXT:NEXT                  :rem 10
5517 IFTP=207THENPOKECM,5:POKEG,207:RETUR
     N                               :rem 185
5519 IFTP=194THENPOKECM,1:POKEG,194:RETUR
     N                               :rem 193
5520 IFTP=BTHENPOKEG,B:RETURN        :rem 171
5530 IFTP=191THENSC=SC+10:GOTO5900:rem 61
5540 IFTP=192THENSC=SC+20:GOTO5900:rem 64
5550 IFTP=193THENSC=SC+40:GOTO5900:rem 68
5560 SC=SC+5:E=E-1:POKEG,B:PRINT"{HOME}
     {6 RIGHT}";SC:RETURN            :rem 205
5800 IFMP=195THENCP=-22:RETURN       :rem 127
5810 IFMP=196THENCP=22:RETURN        :rem 84
5820 IFMP=197THENCP=-1:RETURN        :rem 80
5830 IFMP=198THENCP=-23:RETURN       :rem 134
5840 IFMP=199THENCP=21:RETURN        :rem 89
5850 IFMP=200THENCP=1:RETURN         :rem 23
5860 IFMP=201THENCP=-21:RETURN       :rem 120
5870 CP=23:RETURN                    :rem 35
5900 POKECM,1:POKEG,194:PRINT"{HOME}
     {6 RIGHT}";SC                   :rem 1
5905 FI=FI+1:IFFI=QFTHEN7000         :rem 172
5907 RETURN                          :rem 181
7000 PRINTDN$"{3 RIGHT}LEVEL";LV;"COMPLET
     ED":TL=ET-VAL(TI$)              :rem 232
7005 PRINTTAB(4)"TIME BONUS:";TL     :rem 196
7010 SC=SC+TL:LV=LV+1:D=D+4:QW=QW+1:E=QW:
     ET=ET+14:WL=WL+1                :rem 74
7015 IFD>37THEND=37                  :rem 98
7020 IFD>70THEND=70                  :rem 88
7030 IFET>500THENET=500              :rem 95
7035 IFQW>20THENQW=20                :rem 28
7037 IFWL>40THENWL=40                :rem 24
7040 FORK=1TO999:NEXT:GOTO25         :rem 12
8000 PRINTDN$"{3 RIGHT}TOO MANY WEEDS!":G
     OTO9000                         :rem 162
8100 PRINTDN$"{6 RIGHT}TIME'S UP!":GOTO90
     00                              :rem 169
9000 IFSC>HSTHENHS=SC                :rem 100
9004 FORJ=1TO999:NEXT                :rem 51
9005 PRINT"{CLR}"TAB(2)"HIGH SCORE:";HS
                                     :rem 124
9008 PRINT"{DOWN} YOUR SCORE WAS";SC:PRIN
     T"{DOWN} YOU ACHIEVED LEVEL";LV
                                     :rem 225
9010 PRINTDN$"{7 DOWN}PRESS TRIGGER TO PL
     AY"                             :rem 66
9020 REM CHECK BUTTON                :rem 233
9030 GOTO9020                        :rem 208
```

Program 3: Pests For PC/PCjr

```
2 DEF SEG=0:POKE 1047,240:SCREEN 0,1
4 WIDTH 40:KEY OFF
5 DEF SEG=&HB800
20 DIM PP(200),JP(9)
23 SC=0:D=15:E=3:QW=E:ET=200:WL=20:LV=1
25 RS=399:AV=160:U=80:B=32:FC=14:FI=0:GO
SUB 3000:TIME$="00:00:00"
31 CLS:COLOR 7,0:LOCATE 1,1,0:PRINT" SCO
RE:";SC:LOCATE 1,15:PRINT"LEVEL:";LV:LOC
ATE 1,28:PRINT"TIME ";RIGHT$(TIME$,4)
32 COLOR 9,0:LOCATE 2,1:PRINT CHR$(218)S
TRING$(38,196)CHR$(191);
33 FOR I=1 TO 20:PRINT CHR$(179)STRING$(
38,32)CHR$(179);:NEXT I
34 PRINT CHR$(192)STRING$(38,196)CHR$(21
7);
36 QF=0
39 FOR K=1 TO 3:FOR J=1 TO D
40 FP=(INT(RND*RS)*4)+AV:SP=FP+U
50 IF PEEK(FP)<>B THEN 40
55 IF PEEK(SP)<>B THEN 40
60 POKE FP+1,FC:POKE FP,15:POKE SP+1,2:P
OKE SP,25:QF=QF+1:NEXT:D=D-10
70 IF FC=14 THEN FC=3:GOTO 90
80 FC=4
90 NEXT:D=D+30:OP=162:NP=162:POKE OP,1:P
OKE OP+1,7:WC=203:X=0:GOSUB 300:TIME$="0
0:00:00":GOTO 110

100 IF H<0 THEN H=0
101 IF E<0 THEN E=0
103 IF WC=206 THEN WC=203:X=X+E:GOSUB 30
0:GOTO 110
105 GOSUB 320
110 GOSUB 11000:L=TI+8:GOTO 4000
300 E=E+1:FOR H=X TO X+E
305 WP=INT(RND*(RS*4))+AV:IF PEEK(WP)<>B
 THEN 305
310 PP(H)=WP:POKE PP(H)+1,6:POKE PP(H),W
C:NEXT:IF H>WL THEN 8000
315 RETURN
320 FOR H=X TO X+E:POKE PP(H)+1,6:POKE P
P(H),WC:NEXT:RETURN
3000 REM JOYSTICK INITIALIZER
3010 JP(0)=0:JP(1)=78:JP(2)=80:JP(3)=82:
JP(4)=-2:JP(6)=2:JP(7)=-82:JP(8)=-80:JP(
9)=-78:DO=191:CS=1
3020 RETURN
4000 I$=INKEY$:JV=VAL(I$):FR=(I$=" ")
4002 IF JV THEN CP=JP(JV)
4005 IF FR THEN GOSUB 5500
4010 NP=OP+JP(JV):IF PEEK(NP)<>B THEN NP
=OP
4012 IF NP=OP THEN 4020
4015 POKE NP+1,7:POKE OP,B:POKE NP,CS:OP
=NP
4020 GOSUB 11000:IF TI>L THEN WC=WC+1:GO
TO 100
4025 COLOR 7,0:LOCATE 1,33:PRINT RIGHT$(
TIME$,4);:GOSUB 11000:IF TI>ET THEN 8100

4030 GOTO 4000
5500 REM SPRAY WEEDS & FLOWERS
5505 G=NP+CP+1:TP=PEEK(G):TQ=PEEK(G-1):I
F TP<>3 AND TP<>4 AND TP<>14 AND TP<>6 T
HEN RETURN
5510 POKE G,7:POKE G-1,254
5515 FOR I=1 TO 2:SOUND 110,2:FOR J=1 TO
 100:NEXT J,I
5530 IF TP=3 THEN SC=SC+10:GOTO 5900
5540 IF TP=4 THEN SC=SC+20:GOTO 5900
5550 IF TP=14 THEN SC=SC+40:GOTO 5900
```

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```
5560 SC=SC+5:E=E-1:POKE G-1,B:LOCATE 1,8
:PRINT SC;:RETURN
5900 POKE G,15:POKE G-1,15:LOCATE 1,8:PR
INT SC;
5910 FI=FI+1:IF FI<>0F THEN RETURN
7000 LOCATE 12,11:PRINT"Level";LV;"Compl
eted":GOSUB 11000:TL=ET-TI
7002 LOCATE 14,12:PRINT"Time Bonus:";TL
7005 SC=SC+TL:LV=LV+1:D=D+4:QW=QW+1:E=QW
:ET=ET+14:WL=WL+1
7020 IF D>70 THEN D=70
7030 IF ET>500 THEN ET=500
7035 IF QW>20 THEN QW=20
7037 IF WL>40 THEN WL=40
7040 FOR K=1 TO 999:NEXT:GOTO 25
8000 LOCATE 12,13:PRINT"Too Many Weeds!!
":GOTO 9000
8100 LOCATE 12,15:PRINT"Time's up!!"
9000 IF SC>HS THEN HS=SC
9004 FOR J=1 TO 999:NEXT
9005 CLS:LOCATE 3,12:PRINT"High Score:";
HS
9008 LOCATE 5,10:PRINT"Your Score Was";S
C:LOCATE 7,10:PRINT"You Achieved Level:"
;LV
9010 LOCATE 19,6:PRINT"Press SPACE BAR t
o play again"
9020 IF INKEY$=" " THEN 23 ELSE 9020
11000 TI=VAL(MID$(TIME$,4,2))*100+VAL(RI
GHT$(TIME$,2)):RETURN
```

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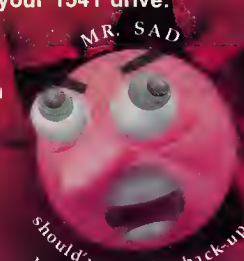

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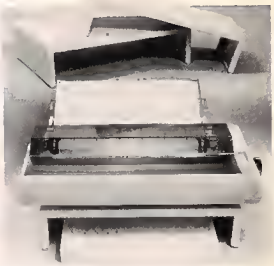

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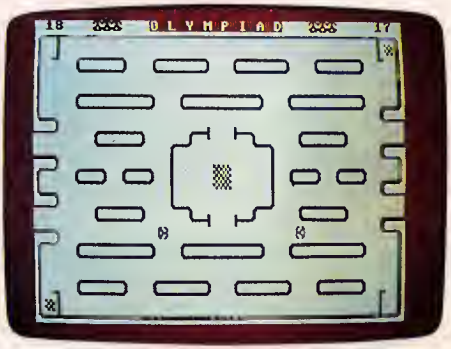
Olympiad

Kevin Waram and Mike Buhidar, Jr.

In this mythical struggle between a magician and a king, you decide the fate of the realm with your joystick. Written for the 64, we've included versions for the VIC and Atari.



Players get ready to challenge each other ("Olympiad," 64 version).

Long ago Admar, a magician of great power, served the king of Denbar as an advisor in matters of war. Through the years Admar's power grew so much that the king began to fear him. Foolishly, the king decided that because of his power, Admar could no longer be trusted, and he plotted to kill the magician.

Admar, however, was still loyal to the king, and when he learned of the king's plot he decided to flee the kingdom with a legion of his own loyal warriors.

The king followed with his army and attacked Admar's stronghold, resulting in heavy casualties on both sides. Both the king and Admar now realized that warfare would be very costly in lives.

An Enchanted Arena

So it was agreed that an enchanted arena should be built where the king's Black Knights would do mock battle with Admar's Red Knights.

You and a friend control the actions of the knights as they fight for their masters. Movement in all eight directions is controlled by the joystick. The red knight is controlled by the joystick in control port 1, the black knight by the joystick in port 2.

The knights have also been given 20 magical arrows which stun on contact. The arrows are launched by pressing the fire button. When a fighter has used all of his arrows, his only defense is to run.

Teleportation Grids

To add an element of randomness to the battle, three enchanted teleportation grids have been added to the arena. When any warrior steps onto one of these grids, he is instantly teleported to a random position in the arena.

If you want to save yourself the trouble of typing in this program (64 version *only*), just send a blank cassette or diskette (1541 format), a self-addressed, stamped mailer, and $3 to either address listed below. Please specify that you wish a copy of the "Olympiad" program.

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"Standing on the top of the Olympic victory stand is like stretching one's body on the top of the world. It is a moment where the individual man or woman gets introduced to the whole planet. It is a moment that is his or hers alone."

—Olga Connolly
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Program 1: Olympiad For The 64

Refer to the "Automatic Praofreoder" article before typing this program in.

```
1 POKE53280,2:POKE53281,1:GOTO1000
                                    :rem 189
2 DIM X(15),CS(15),D2(15),C2(15)  :rem 69
4 CLR:N=15:B=32:FJ=56320:FT=56321:CO=5427
  2:JB=16:HP=102:GOSUB500          :rem 223
10 RN=1:RO=1104:FB=1030:FO=1054:LB=1032:L
   R=1056:GOSUB3000                :rem 15
20 DX(0)=0:DX(1)=-40:DX(2)=40:DX(4)=-1:DX
   (5)=-41:DX(6)=39:DX(8)=1:DX(9)=-39
                                    :rem 54
22 D2(0)=0:D2(1)=-40:D2(2)=40:D2(4)=-1:D2
   (5)=-41:D2(6)=39:D2(8)=1:D2(9)=-39
                                    :rem 8
25 DX(10)=41:CS(0)=192:CS(1)=194:CS(2)=19
   5:CS(4)=193:CS(5)=198:CS(6)=197
                                    :rem 118
27 D2(10)=41:C2(0)=193:C2(1)=194:C2(2)=19
   5:C2(4)=193:C2(5)=198:C2(6)=197
                                    :rem 141
30 CS(8)=192:CS(9)=196:CS(10)=199:rem 244
32 C2(8)=192:C2(9)=196:C2(10)=199:rem 147
34 RESTORE:GOSUB400:FORNP=13824TO13983:RE
   ADMD:POKENP,MD:NEXT              :rem 166
36 PRINT"{2 UP}";SPC(JB);"{7 SPACES}"
                                    :rem 217
50 OP=1105:O2=1982:POKEOP,195:POKEO2,194:
   POKEOP+CO,0:POKE02+CO,5          :rem 101
60 IF AT+NA=0 THEN POKEOP,B:POKEO2,B:RN=R
   N-1:GOTO34                       :rem 99
61 JV=N-(PEEK(FJ)ANDN):FR=PEEK(FJ)ANDJB:C
   S(0)=CS(JV):UP=OP+DX(JV)         :rem 51
65 IFPEEK(UP)<>BTHENGOSUB4000       :rem 68
70 POKEOP,B:POKEUP+CO,0:POKEUP,CS(JV):OP=
   UP                               :rem 70
75 IFFR<>JBTHENGOSUB100             :rem 217
80 J2=N-(PEEK(FT)ANDN):F2=PEEK(FT)ANDJB:C
   2(0)=C2(J2):U2=O2+D2(J2)         :rem 24
85 IFPEEK(U2)<>BTHENGOSUB4100       :rem 41
90 POKEO2,B:POKEU2+CO,2:POKEU2,C2(J2):O2=
   U2                               :rem 111
95 IFF2<>JBTHENGOSUB110             :rem 188
97 GOTO60                           :rem 15
99 REM SHOOT ARROW                  :rem 110
100 IFNA=0THENRETURN                :rem 43
101 NA=NA-1:BP=INT(NA/10):IFBP>1THENBP=1
                                    :rem 168
102 PRINT"{HOME}{BLK}";NA:POKE1026+BP,B:D
    =DX(JV):JC=CS(JV):GOSUB200      :rem 77
105 AP=UP+D:C1=0:GOTO115            :rem 157
110 IFAT=0THENRETURN                :rem 50
111 AT=AT-1:BT=INT(AT/10):IFBT>1THENBT=1
                                    :rem 199
112 PRINT"{HOME}{RED}";SPC(36);AT:POKE106
    2+BT,B:D=D2(J2):JC=C2(J2):GOSUB200
                                    :rem 48
114 AP=U2+D:C1=2                    :rem 119
115 AD=JC+8:IFPEEK(AP)<>BTHENRETURN
                                    :rem 228
120 FORA=1TO15:NP=AP+D              :rem 71
125 AC=NP+CO                        :rem 180
130 IFPEEK(NP)<>BTHEN300            :rem 181
140 POKEAP,B:POKEAC,C1:POKENP,AD:AP=NP:NE
    XT:POKEAP,B:RETURN              :rem 169
199 REM STILL CHECKER               :rem 4
200 IFD<>0THENRETURN                :rem 30
210 IFJC=194THEND=-40:RETURN        :rem 229
220 IFJC=195THEND=40:RETURN         :rem 186
230 IFJC=193THEND=-1:RETURN         :rem 179
240 IFJC=198THEND=-41:RETURN        :rem 237
250 IFJC=197THEND=39:RETURN         :rem 199
260 IFJC=192THEND=1:RETURN          :rem 136
270 IFJC=196THEND=-39:RETURN        :rem 245
280 D=41:RETURN                     :rem 154
299 REM DEATH                       :rem 238
300 IFPEEK(NP)<192THENPOKEAP,B:RETURN
                                    :rem 133
310 IFC1=0THEN330                   :rem 201
312 POKELB,B:LB=LB-1:GOSUB600       :rem 2
315 IFLB=FB-1THEN6000               :rem 206
317 GOTO34                          :rem 59
330 POKELR,B:LR=LR-1:GOSUB610       :rem 51
335 IFLR=FO-1THEN6010               :rem 238
340 GOTO34                          :rem 55
```

Notes For VIC And Atari Versions

Chris Poer, Editorial Programmer

The object of "Olympiad" is to defeat your opponent's three knights with three of your own in one-on-one combat. In the VIC version, player 1 controls his knight with the joystick while player 2 uses the keyboard (I, J, K, and M keys for up, left, right, and down movements, respectively). In the Atari version, the knights are controlled with joysticks 0 and 1.

When the game begins, position yourself directly in front of the enemy. Press the joystick button (or space bar in the VIC version) to fire an arrow. Arrows travel only a certain distance. In addition, each knight has only 20 arrows in his quiver, so be careful not to waste any. If both warriors exhaust their supply of arrows, the round will start anew, with each player receiving a fresh supply of 20 arrows.

The VIC version requires 8K or more of expansion RAM. Before loading the game into the VIC (right after the computer is turned on), carefully enter the following lines:

```
POKE43,1:POKE44,32:POKE8192,0:NEW
POKE36869,240:POKE36866,150:POKE648,30
PRINT"{CLR}"
```

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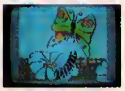

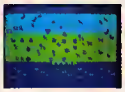

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```
400 NA=20:AT=20:PRINT"{HOME}{BLK}";NA;SPC
    (32);"{RED}";AT                    :rem 234
410 PRINT"{BLU}{HOME}{2 DOWN}{RVS}";SPC(1
    6);"ROUND";RN;"{OFF}":RN=RN+1:RETURN
                                       :rem 197
500 REM SOUND INITIALIZATION           :rem 42
510 S=54272:FORQ=STOS+24:POKEQ,0:NEXT
                                       :rem 66
520 POKES+24,15:POKES+5,17:POKES+6,248
                                       :rem 211
525 POKES,150:POKES+1,150              :rem 186
530 RETURN                             :rem 120
600 DP=UP:OM=U2:GOTO620                :rem 177
610 DP=U2:OM=UP                        :rem 167
620 POKEAP,B:POKEOM,B:GOSUB7000:FORK=210T
    O208STEP-1:POKEDP,K                :rem 65
630 FORH=1TO100:NEXT:NEXT:POKEDP,211:POKE
    DP,B:POKEUP,B:POKEU2,B:RETURN:rem 120
1000 REM CHR. SET LOADER               :rem 83
1010 PRINT"{CLR}{BLK}LOADING CHARACTER SE
    T INTO MEMORY. . .":PRINTCHR$(142)
                                       :rem 122
1020 POKE52,48:POKE56,48:CLR:G=56334
                                       :rem 59
1030 POKEG,PEEK(G)AND254               :rem 145
1040 POKE1,PEEK(1)AND251               :rem 99
1045 IFPEEK(13983)=102THEN1060         :rem 157
1050 FORI=0TO2047:POKEI+12288,PEEK(I+5324
    8):NEXT                            :rem 74
1060 POKE1,PEEK(1)OR4                  :rem 207
1070 POKEG,PEEK(G)OR1                  :rem 249
1080 POKE53272,(PEEK(53272)AND240)+12
                                       :rem 232
1090 FORNP=13824TO13983:READMD:POKENP,MD:
    DC=DC+MD:NEXT                      :rem 158
1095 IFDC<>13392THENPRINT"ERROR IN DATA.
    {SPACE}. .":STOP                   :rem 166
1100 GOTO2                             :rem 45
1999 REDEFINED CHARACTERS              :rem 66
2000 DATA102,227,241,159,159,241,227,102
                                       :rem 216
2010 DATA102,199,143,249,249,143,199,102
                                       :rem 235
2020 DATA126,219,153,24,60,231,231,126
                                       :rem 113
2030 DATA126,231,231,60,24,153,219,126
                                       :rem 114
2040 DATA60,6,207,253,201,201,124,60
                                       :rem 6
2050 DATA60,62,147,147,191,243,96,60
                                       :rem 36
2060 DATA60,96,243,191,147,147,62,60
                                       :rem 37
2070 DATA60,124,201,201,253,207,6,60
                                       :rem 9
20B2 DATA0,132,66,63,66,132,0,0,0,33,66,2
    52,66,33,0,0,16,56,84,16,16,16,40,68
                                       :rem 233
2084 DATA68,40,16,16,16,84,56,16,7,3,5,8,
    16,224,32,32,4,4,7,B,16,160,192,224
                                       :rem 202
2086 DATA224,192,160,16,8,7,4,4,32,32,224
    ,16,8,5,3,7                        :rem 39
2088 DATA0,0,8,16,4,16,0,0             :rem 26
2090 DATA0,0,20,10,32,20,0,0           :rem 99
2092 DATA68,9,32,132,1,40,130,17       :rem 78
2094 DATA0,0,0,0,0,0,0,0               :rem 157
2999 REM PLAYFIELD                     :rem 91
3000 PRINT"{CLR}{RED}{12 SPACES}{RVS}O L
    {SPACE}Y M P I A D{OFF}{14 SPACES}"
                                       :rem 70
3001 NA=20:AT=20:PRINT"{HOME}";NA;SPC(B);
    AT                                 :rem 204
3002 FORL=1024TO1035:POKEL+CO,0:NEXT:FORL
    =1057TO1062:POKEL+CO,2:NEXT        :rem 219
3004 FORL=FBTOLB:POKEL,194:NEXT:FORL=FOTO
    LR:POKEL,194:NEXT                  :rem 96
3010 PRINT"{UP}{BLK}UC{R}CCCCCCCCCCCCCC
    CCCCCCCCCCCCCCCCCC{R}CI"           :rem 36
3020 GOSUB3990:POKE1106+CO,0:POKE1106,66:
    POKE1141+CO,0:POKE1141,66:POKE1142,H
    P                                  :rem 51
3030 POKE1142+CO,2:PRINT"{UP}B {X} UCCC
    CI{2 SPACES}UCCCCCI{2 SPACES}UCCCCCI
    {2 SPACES}UCCCCI {Z} B"            :rem 144
3040 PRINT"{UP}B{3 SPACES}JCCCCK
    {2 SPACES}JCCCCCK{2 SPACES}JCCCCCK
    {2 SPACES}JCCCCK{3 SPACES}B":rem 183
3050 GOSUB3990                         :rem 29
3060 PRINT"{UP}B{3 SPACES}UCCCCCCCI
    {2 SPACES}UCCCCCCCCI{2 SPACES}UCCCCC
    CCI{3 SPACES}B"                    :rem 75
3070 PRINT"{UP}B{3 SPACES}JCCCCCCCK
    {2 SPACES}JCCCCCCCCK{2 SPACES}JCCCCC
    CCK UCK"                           :rem 210
3080 PRINT"{UP}JCI";SPC(34);"JCC"      :rem 43
3090 PRINT"{UP}CCK{3 SPACES}UCCCCI
    {4 SPACES}UC{W}{2 SPACES}{Q}CI
    {4 SPACES}UCCCCI"                  :rem 85
3100 PRINT"{6 SPACES}JCCCCK{2 SPACES}UCK
    {6 SPACES}JCI{2 SPACES}JCCCCK
    {3 SPACES}UCC"                     :rem 235
3110 PRINT"{UP}CCI{11 SPACES}B{10 SPACES}
    B{11 SPACES}JCI"                   :rem 80
3120 PRINT"{UP}UCK UCCI UCCI B{4 SPACES}
    {BLK}{+}{RED}{+}{BLK}{4 SPACES}B
     UCCI UCCI{3 SPACES}B"             :rem 233
3130 PRINT"{UP}B{3 SPACES}JCCK JCCK B
    {4 SPACES}{RED}{+}{BLK}{+}
    {4 SPACES}B JCCK JCCK UCK"         :rem 54
3140 PRINT"{UP}JCI{11 SPACES}B{10 SPACES}
    B{11 SPACES}JCC"                   :rem 84
3150 PRINT"{UP}CCK{3 SPACES}UCCCCI
    {2 SPACES}JCI{6 SPACES}UCK{2 SPACES}
    UCCCCI{6 SPACES}"                  :rem 137
3160 PRINT"{UP}{6 SPACES}JCCCCK{4 SPACES}
    JC{W}{2 SPACES}{Q}CK{4 SPACES}JC
    CCCK{3 SPACES}UCC"                 :rem 66
3170 PRINT"{UP}CCI{34 SPACES}JCI":rem 210
3180 PRINT"{UP}UCK UCCCCCCCI{2 SPACES}UCC
    CCCCCCI{2 SPACES}UCCCCCCCI{3 SPACES}
    B"                                 :rem 239
3190 PRINT"{UP}B{3 SPACES}JCCCCCCCK
    {2 SPACES}JCCCCCCCCK{2 SPACES}JCCCCC
    CCK{3 SPACES}B"                    :rem 52
3200 GOSUB3990                         :rem 26
3210 PRINT"{UP}B{3 SPACES}UCCCCI
    {2 SPACES}UCCCCCI{2 SPACES}UCCCCCI
    {2 SPACES}UCCCCI{3 SPACES}B":rem 218
3220 PRINT"{UP}B {S} JCCCCK{2 SPACES}JC
    CCCCK{2 SPACES}JCCCCCK{2 SPACES}JCCC
    CK {A} B"                          :rem 21
3230 PRINT"{UP}B":POKE1945,HP          :rem 236
3245 FORL=56215TO56295:POKEL,0:NEXT
                                       :rem 121
3250 POKE1983,93:POKE1984,74:FORL=1985TO2
    022:POKEL,67:NEXT                  :rem 237
3260 POKE1986,113:POKE1946,66:POKE2021,11
    3:POKE1981,66:POKE2023,75:RETURN
                                       :rem 13
3990 PRINT"{UP}B";SPC(38);"B":RETURN
                                       :rem 49
```

All roads to the best strategy games for the ATARI® lead to SSI.

As the hero in this fantasy adventure role-playing game, you must battle hordes of deadly monsters as you seek out to destroy the evil wizard, Mantor. Use your strength, dexterity, intelligence and charisma to the fullest in your treacherous journey to save the Questron Empire. On 40K disk. $49.95.

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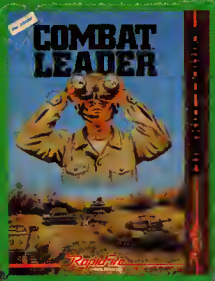

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SSI

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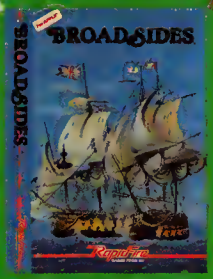

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```
3999 REM HIT DATA                    :rem 193
4000 IFPEEK(UP)<>HPTHENUP=OP:RETURN
                                     :rem 74
4010 RF=INT(RND(1)*879)+RO:IFPEEK(RF)<>BT
     HEN4010                         :rem 97
4020 UP=RF:POKEUP+CO,0:POKEOP,B:MP=UP:JP=
     JV:GOSUB5000                    :rem 198
4100 IFPEEK(U2)<>HPTHENU2=O2:RETURN
                                     :rem 241
4110 R2=INT(RND(1)*879)+RO:IFPEEK(R2)<>BT
     HEN4110                         :rem 59
4120 U2=R2:POKEU2+CO,2:POKEO2,B:MP=U2:JP=
     J2:GOSUB5000:RETURN             :rem 51
5000 FORMN=208TO210:POKEMP,MN:FORW=1TO150
     :NEXT:NEXT:POKEMP,CS(JP):RETURN
                                     :rem 255
5999 REM END ROUTINE                 :rem 193
6000 WN$=" RED ":LS$=" BLACK ":T1=4:T2=4:
     GOTO6020                        :rem 98
6010 WN$=" BLACK ":LS$=" RED ":T1=3:T2=5
                                     :rem 40
6020 PRINT"{CLR}";TAB(T1);"{DOWN}{BLK}THE
     ";WN$;"KNIGHTS WERE VICTORIOUS!
     {DOWN}"                         :rem 44
6030 PRINTTAB(T2);"THEY DEFEATED THE";LS$
     ;"KNIGHTS{DOWN}"                :rem 118
6040 PRINTTAB(14);"IN";RN-1;"ROUNDS"
                                     :rem 141
6060 PRINT"{15 DOWN}{4 SPACES}PRESS <<SPA
     CEBAR>> TO PLAY AGAIN{3 SPACES}"
                                     :rem 151
6065 GETI$:IFI$<>" "THEN6065         :rem 18
6070 GOTO4                           :rem 58
7000 REM DEATH SOUND                 :rem 154
7010 POKES+4,129:FORQ=1TO30:NEXT:POKES+4,
     128                             :rem 178
7040 RETURN                          :rem 171
```

The contest is about to start (VIC version, "Olympiad").

Program 2: Olympiad For VIC

Refer to the "Automatic Proofreader" article before typing this program in.

```
0 POKE36879,26:GOTO 1000             :rem 56
1 SCR=256*PEEK(648):A=30720:IFPEEK(648)=1
  6THEN A=33792                      :rem 35
2 DIM X(50),CS(50),D2(50),C2(80),DX(50)
                                     :rem 194
4 N=15:B=32:V=36878:S1=36874:S4=36877
                                     :rem 52
5 PB=37152:JB=16:HP=102              :rem 18
10 RN=1:COL=A:LB=SC+4:FB=SC+10       :rem 32
15 RO=SC+22:FB=SC+3:FO=SC+15:LB=SC+4:LR=S
   C+15:GOSUB 3000                   :rem 66
22 D2(0)=0:D2(1)=-22:D2(2)=22:D2(4)=-1:D2
   (5)=-23:D2(6)=21:D2(8)=1:D2(9)=-21
                                     :rem 246
25 DX(10)=23:CS(25)=192:CS(23)=193:CS(46)
   =195:CS(2)=194:CS(45)=197         :rem 21
27 D2(10)=23:C2(12)=194:C2(20)=193:C2(44)
   =192:C2(36)=195                   :rem 51
30 CS(47)=199:CS(3)=196:CS(1)=198:rem 247
34 RESTORE:GOSUB400:XX=0:CS(0)=195:C2(0)=
   194:FORI=1TO160:READPI:NEXT       :rem 226
36 PRINT"{3 UP}";SPC(JB/2);"{7 SPACES}"
                                     :rem 203
49 OP=SCR+45:O2=SCR+482:UP=OP:U2=O2
                                     :rem 168
50 POKEOP,195:POKEO2,194:POKEOP+CO,0:POKE
   O2+CO,2                           :rem 216
60 IF NA+AT=0 THEN POKE OP,B:POKEO2,B:RN=
   RN-1:GOTO34                       :rem 99
61 POKE 37154,127:P=PEEK(37152)AND128:J0=
   -(P=0):POKE37154,255              :rem 110
63 P=PEEK(37151):J1=-((PAND8)=0):J2=-((PA
   ND16)=0):J3=-((PAND4)=0)          :rem 54
64 IF-((PAND32)=0)=1THENGOSUB 100:rem 107
65 IF XX=1 THEN 34                   :rem 174
66 VV=(J0-J2)+(J1-J3)*22:IFVV=0THEN75
                                     :rem 117
67 UP=OP+VV:JV=VV+24:CS(0)=CS(JV) :rem 46
68 IF(PEEK(UP)<>B)AND(PEEK(UP)<>96)THENGO
   SUB4000:GOTO 75                   :rem 159
70 POKEOP,B:POKEUP+CO,0:POKEUP,CS(JV):OP=
   UP                                :rem 70
75 AA=PEEK(197):IF(AA<>12)AND(AA<>20)AND(
   AA<>36)AND(AA<>44)THEN95          :rem 235
76 BB=INT(AA/10):ONBBGOTO80,78,77,79
                                     :rem 73
77 U2=O2+22:GOTO81                   :rem 30
78 U2=O2-1:GOTO81                    :rem 238
79 U2=O2+1:GOTO81                    :rem 237
80 U2=O2-22                          :rem 62
81 IF(PEEK(U2))<>BAND(PEEK(U2)<>96)THENGO
   SUB4100:GOTO 95                   :rem 97
82 IF XX=1 THEN 34                   :rem 173
90 POKEO2,B:POKEU2+CO,2:POKEU2,C2(AA):O2=
   U2:CC=AA                          :rem 244
95 IF PEEK(197)=32THENGOSUB110       :rem 247
97 GOTO60                            :rem 15
99 REM SHOOT ARROW                   :rem 110
100 IFNA=0THENRETURN                 :rem 43
101 NA=NA-1:BP=INT(NA/10):IFBP>1THENBP=1
                                     :rem 168
102 PRINT"{HOME}{BLK}";NA:POKESC+2+BP,B:D
    =DX(JV):JC=CS(JV):GOSUB 200      :rem 119
105 AP=UP+D:C1=0:GOTO115             :rem 157
110 IFAT=0THENRETURN                 :rem 50
111 AT=AT-1:BT=INT(AT/10):IFBT>1THENBT=1
                                     :rem 199
112 PRINT"{HOME}{RED}";SPC(18);AT:POKESC+
    20+BT,B:D=D2(CC):JC=C2(CC):GOSUB200
                                     :rem 158
114 AP=U2+D:C1=2                     :rem 119
115 AD=JC+8:IF(PEEK(AP)<>B)AND(PEEK(AP)<>
    96)THENRETURN                    :rem 73
120 POKEV,2:POKES4,200:FORA=1TO13:NP=AP+D
                                     :rem 16
125 AC=NP+CO                         :rem 180
```

IS YOUR CHILD TOP BANANA, OR JUST ONE OF THE BUNCH?

Kids everywhere are going ape over Artworx® Monkey Series educational software! Like all good arcade games, kids just can't stop playing them. Which is great, because while they're enjoying the antics of Marc the Monkey, they're learning. And growing.

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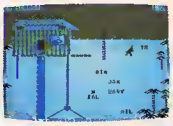

Monkeybuilder

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$24.95

Monkeynews
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Monkeybuilder
by Dean Kindig and Rob Fitter
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Artworx®

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```
130 IF(PEEK(NP)<>B)AND(PEEK(NP)<>96)THENP
    OKEV,0:POKES4,0:GOTO300          :rem 199
140 POKEAP,B:POKEAC,C1:POKENP,AD:AP=NP:NE
    XT:POKEAP,B:POKEV,0:POKES4,0:RETURN
                                     :rem 16
199 REM STILL CHECKER                :rem 4
200 IFD<>0THENRETURN                 :rem 30
210 IFJC=192THEND=1:RETURN           :rem 131
220 IFJC=193THEND=-1:RETURN          :rem 178
230 IFJC=195THEND=22:RETURN          :rem 187
240 IFJC=194THEND=-22:RETURN         :rem 232
250 IFJC=197THEND=21:RETURN          :rem 190
260 IFJC=198THEND=-23:RETURN         :rem 239
270 IFJC=194THEND=-21:RETURN         :rem 234
280 D=23:RETURN                      :rem 154
299 REM DEATH                        :rem 238
300 IFPEEK(NP)<192THENPOKEAP,B:RETURN
                                     :rem 133
310 IFC1=0THEN330                    :rem 201
312 POKELB,B:LB=LB+1:GOSUB600          :rem 0
315 IFLB=SC+7THEN6000                :rem 224
317 XX=1:RETURN                      :rem 211
330 POKELR,B:LR=LR+1:GOSUB610         :rem 49
335 IFLR=SC+18THEN6010                :rem 37
340 XX=1:RETURN                      :rem 207
400 NA=20:AT=20:PRINT"{HOME}{BLK}";NA;SPC
    (14);"{RED}";AT                  :rem 234
410 PRINT"{BLU}{HOME}{2 DOWN}{RVS}";SPC(8
    );"ROUND";RN;"{OFF}":RN=RN+1:RETURN
                                     :rem 150
600 DP=UP:OM=U2:GOTO620              :rem 177
610 DP=U2:OM=UP                      :rem 167
620 POKEAP,B:POKEOM,B:FORK=210TO208STEP-1
    :POKEDP,K:FORH=1TO100:NEXT:NEXT
                                     :rem 189
630 POKEDP,211:GOSUB7000:POKEDP,B:POKEUP,
    B:POKEU2,B:RETURN                :rem 252
650 IFJC=196THEND=21:RETURN          :rem 193
1000 PRINT"{CLR}{BLK}LOADING CHARACTER SE
     T INTO MEMORY. . .":PRINTCHR$(142)
                                     :rem 121
1010 FORI=5120TO7168:POKEI,PEEK(I+27648):
     NEXT                            :rem 188
1020 POKE 36869,253                  :rem 200
1045 IFPEEK(13983)=102THEN1060       :rem 157
1090 FORNP=6656TO6815:READMD:POKENP,MD:NE
     XT                              :rem 254
1100 GOTO 1                           :rem 44
1999 REDEFINED CHARACTERS             :rem 66
2000 DATA102,227,241,159,159,241,227,102
                                     :rem 216
2010 DATA102,199,143,249,249,143,199,102
                                     :rem 235
2020 DATA126,219,153,24,60,231,231,126
                                     :rem 113
2030 DATA126,231,231,60,24,153,219,126
                                     :rem 114
2040 DATA60,6,207,253,201,201,124,60
                                       :rem 6
2050 DATA60,62,147,147,191,243,96,60
                                      :rem 36
2060 DATA60,96,243,191,147,147,62,60
                                      :rem 37
2070 DATA60,124,201,201,253,207,6,60
                                       :rem 9
2082 DATA0,132,66,63,66,132,0,0,0,33,66,2
     52,66,33,0,0,16,56,84,16,16,16,40,68
                                     :rem 233
2084 DATA68,40,16,16,16,84,56,16,7,3,5,8,
     16,224,32,32,4,4,7,8,16,160,192,224
                                     :rem 202
2086 DATA224,192,160,16,8,7,4,4,32,32,224
     ,16,8,5,3,7                     :rem 39
2088 DATA0,0,8,16,4,16,0,0           :rem 26
2090 DATA0,0,20,10,32,20,0,0         :rem 99
2092 DATA68,9,32,132,1,40,130,17     :rem 78
2093 DATA 0,0,0,0,0,0,0,0           :rem 156
2094 REMDATA126,90,126,60,0,102,24,102
                                     :rem 190
2605 IFJC=198THEND=-23:RETURN        :rem 36
2999 REM PLAYFIELD                   :rem 91
3000 PRINT"{7 SPACES}OLYMPIAD"       :rem 243
3010 PRINT"U*{RVS}****************{RVS}*I";
                                     :rem 82
3020 PRINT"- -{16 SPACES}-{RED}{+}{BLU}
     -";                             :rem 38
3030 PRINT"-{3 SPACES}U**I U**I U**
     I{3 SPACES}-";                  :rem 230
3040 PRINT"-{3 SPACES}J**K{SHIFT-SPACE}
     J**K{SHIFT-SPACE}J**K{3 SPACES}-
     ";                              :rem 12
3050 PRINT"-{20 SHIFT-SPACE}-";      :rem 14
3060 PRINT"- U***I{8 SPACES}U***I
     {SHIFT-SPACE}-";                :rem 235
3070 PRINT"-{SHIFT-SPACE}J***K
     {8 SPACES}J***K{SHIFT-SPACE}-";
                                     :rem 122
3080 PRINT"-{2 SHIFT-SPACE}{5 SPACES}U
     {W}{2 SPACES}{Q}I
     {5 SHIFT-SPACE} -";             :rem 237
3090 PRINT"-{6 SPACES}UK{4 SPACES}JI
     {2 SPACES}UI{2 SPACES}-";       :rem 99
3100 PRINT"-{2 SPACES}UI{2 SPACES}-
     {6 SPACES}- UKJI J";            :rem 2
3110 PRINT"K UKJI -{2 SPACES}{RED}{+}
     {BLK}{+}{BLU}{2 SPACES}- JIUK
     {2 SPACES}";                    :rem 211
3120 PRINT"{2 SPACES}JIUK -{2 SPACES}
     {BLK}{+}{RED}{+}{BLU}
     {2 SHIFT-SPACE}-{2 SPACES}JK
     {2 SPACES}U";                   :rem 128
3130 PRINT"I{2 SPACES}JK{2 SPACES}-
     {6 SHIFT-SPACE}-{6 SPACES}-";
                                     :rem 136
3140 PRINT"- {SHIFT-SPACE}{4 SPACES}JI
     {4 SHIFT-SPACE}UK{6 SPACES}-";
                                     :rem 225
3150 PRINT"-{7 SPACES}J{W}{2 SPACES}
     {Q}K{7 SPACES}-";               :rem 130
3155 PRINT"- U***I{8 SPACES}U***I -
     ";                              :rem 80
3160 PRINT"- J***K{8 SPACES}J***K -
     ";{6 SPACES}                    :rem 58
3170 PRINT"-{20 SPACES}-";           :rem 145
3180 PRINT"-{3 SHIFT-SPACE}U**I U**I
     {SHIFT-SPACE}U**I{3 SHIFT-SPACE}-"
     ;                               :rem 76
3190 PRINT"-{3 SPACES}J**K{SHIFT-SPACE}
     J**K{SHIFT-SPACE}J**K{3 SPACES}-
     ";                              :rem 18
3200 PRINT"-{BLK}{+}{BLU}-{16 SPACES}-
     {SPACE}-";                      :rem 154
3210 PRINT"J*{E}****************{E}*";
                                     :rem 126

3220 POKE505+SCR+A,6:POKE505+SCR,75
                                     :rem 31
3225 FORI=0TO2:POKECO+LB+I,0:POKELB+I,195
     :POKECO+LR+I,2:POKELR+I,194     :rem 211
3226 NEXT                            :rem 12
3230 RETURN                         :rem 168
3999 REM HIT DATA                   :rem 193
```

Games from MMG keep you on the run!

PYRAMID RUN

by Mike Marsico & Ed Annunziata

You'll be running for your life when you enter the forbidden pyramid. You're the first person in over 3000 years to have successfully reached the bottom level of the Great Pyramid of the Egyptian Pharaoh Cheotemkahmen, supreme ruler of the Fifth Dynasty, and the jewels and riches are yours to collect! All that remains is to take whatever you can carry, and climb to the top of the pyramid. However, there are still one or two problems to overcome before spending your newly found wealth. The Great Royal Court Sorcerers of the Fifth Dynasty were charged by Cheotemkahmen with the responsibility of ensuring that his eternal sleep should be undisturbed. They ensured that the Demons of the Dark Places would be loosed on any trespasser, and now you've got to conquer them to reach your freedom. Monsters, lightning bolts, radioactive fire, and much more, lie between you and your escape. PYRAMID RUN is a race against time and the Demons of the Dark Places, set upon a scrolling view of the tunnels of the Great Pyramid. You may choose to begin at any of five levels of difficulty. Fantastic full color graphics and spectacular sound effects highlight this game, with dozens of the most hideous and original monsters in computer gaming. In addition, PYRAMID RUN is another of the MMG games which are two in one: as you complete each pyramid, you play a totally different interlude board, for the chance to win additional lives for your next, and more difficult run through the pyramid. PYRAMID RUN requires a disk drive, one joystick and 48K. **Suggested retail price: $29.95**

PHOENIX LAIR

It's a dangerous flight when you are the Phoenix on a search and destroy mission to find enemy eggs. At the beginning of each board, you must leave your nest in search of enemy eggs. After successfully destroying at least six of these eggs, you must return to the far right side of your lair. Points are awarded based on the number of eggs destroyed and the time it takes to complete the mission. A fast mission will result in additional bonus points. You begin with 5 lives and gain additional lives at boards 7, 9, and 10 (if you make it that far). The ten increasingly difficult boards can be played at any of ten speeds and the obstacles you will encounter will make your mission a nightmare. Multiple strategies and bright and lively colors and music add to the already superb play of this completely unique and different game. PHOENIX LAIR also features MMG's interlude board, a head-to-head joust with the Pharis Hailex, principal knight of the Kingdom of Pharis. Successful unseating of the Knight without being hit by his mount gains bonus points. It's like getting two games for the price of one. PHOENIX LAIR requires a disk drive, one joystick and 40K. **Suggested retail price: $29.95**

Available at your favorite computer store or send check or money order to: MMG Micro Software
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Please add $3.00 for postage and handling. Use your Visa, MasterCard or order C.O.D. N.J. residents please add 6% sales tax.

MMG micro software

For Atari and Commodore Computers.

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```
4000 IFPEEK(UP)<>HPTHENUP=OP:RETURN
                                    :rem 74
4010 RF=INT(RND(1)*482)+RO:IFPEEK(RF)<>BT
     HEN4010                        :rem 87
4020 UP=RF:POKEUP+CO,0:POKEOP,B:MP=UP:JP=
     JV:OP=UP:GOSUB5000:RETURN      :rem 155
4100 IFPEEK(U2)<>HPTHENU2=O2:RETURN
                                    :rem 241
4110 R2=INT(RND(1)*482)+RO:IFPEEK(R2)<>BT
     HEN4110                        :rem 49
4120 U2=R2:POKEU2+CO,2:POKEO2,B:MP=U2:JP=
     J2:GOSUB5000:O2=U2:RETURN      :rem 178
5000 FORMN=208TO210:POKEMP,MN:FORW=1TO150
     :NEXT:NEXT:POKEMP,CS(JP):RETURN
                                    :rem 255
5999 REM END ROUTINE                :rem 193
6000 WN$=" RED ":LS$=" BLACK ":GOTO6020
                                    :rem 1
6010 WN$=" BLACK ":LS$=" RED "      :rem 199
6020 PRINT"{CLR}{DOWN}{BLK} THE";WN$;"KNI
     GHTS"                          :rem 73
6030 PRINT" DEFEATED THE";:PRINTLS$
                                    :rem 114
6040 PRINT" KNIGHTS IN ";RN-1;" ROUNDS"
                                    :rem 221
6060 PRINT"{3 DOWN}PRESS SPACEBAR TO PLAY
     ":PRINT"{DOWN} ANY OTHER KEY TO END"
                                    :rem 96
6063 POKE 198,0                     :rem 252
6065 GETI$:IFI$=""THEN6065          :rem 213
6067 IF I$<>" "THEN END             :rem 147
6070 CLR:GOTO1                      :rem 82
6999 REM DEATH SOUND                :rem 180
7000 POKEV,12:POKES4,150:FORI=12TO1STEP-1
     :FORJ=1TO30                    :rem 228
7010 NEXT J:POKEV,I:NEXTI:POKES4,0:RETURN
                                    :rem 173
```

Program 3: Olympiad For Atari

Refer to the "Autamatic Proofreader" article before typing this program in.

```
KP 1  CLOSE #1:OPEN #1,4,0,"K:":GRAPHIC
      S 0:POKE 752,1:POKE 82,0:GOSUB 10
      00:POKE 756,CHSET/256
LB 2  DIM X(15),CS(15),D2(15),C2(15),DX
      (10),LS$(6),WN$(6)
NH 4  N=15:B=0:JB=16:FB=0:FC=0
GP 10 RN=1
CL 11 LB=PEEK(88)+PEEK(89)*256+10:LR=L
      B+17:GOSUB 3000
DG 20 DX(0)=0:DX(1)=-40:DX(2)=40:DX(4)
      =-1:DX(5)=-41:DX(6)=39:DX(8)=1:D
      X(9)=-39
AI 22 D2(0)=0:D2(1)=-40:D2(2)=40:D2(4)
      =-1:D2(5)=-41:D2(6)=39:D2(8)=1:D
      2(9)=-39
OJ 25 DX(10)=41:CS(0)=100:CS(1)=99:CS(
      2)=100:CS(4)=98:CS(5)=103:CS(6)=
      102
OA 27 D2(10)=41:C2(0)=99:C2(1)=99:C2(2
      )=100:C2(4)=98:C2(5)=103:C2(6)=1
      02
KM 30 CS(8)=97:CS(9)=101:CS(10)=104
EL 32 C2(8)=97:C2(9)=101:C2(10)=104
IB 34 GOSUB 400:POSITIDN 17,4:FOR I=1
      TO 500:NEXT I:? "{8 SPACES}"
KB 55 OP=PEEK(88)+PEEK(89)*256+41:O2=O
      P+877:CK=OP
DP 60 IF NA+AT=0 THEN RN=RN-1:POKE OP,
      0:POKE O2,0:GOTO 34
FP 61 JV=N-STICK(0):FR=STRIG(0):CS(0)=
      CS(JV):UP=OP+DX(JV)
EE 65 IF PEEK(UP)<>B THEN GOSUB 4000
BP 70 POKE OP,B:POKE UP,CS(JV):OP=UP
EA 75 IF FR=0 THEN GOSUB 100
DC 80 J2=N-STICK(1):F2=STRIG(1):C2(0)=
      C2(J2):U2=O2+D2(J2)
CJ 85 IF PEEK(U2)<>B THEN GOSUB 4100
CK 90 POKE O2,B:POKE U2,C2(J2)+128:O2=
      U2
CD 95 IF F2=0 THEN GOSUB 110
AP 97 GOTO 60
CL 100 IF NA=0 THEN RETURN
EL 101 NA=NA-1
EP 102 POSITION 4,0:? "  {2 LEFT}";NA;
       :IF NA<10 THEN ? "{R}"
HJ 103 D=DX(JV):JC=CS(JV):GOSUB 200
JH 105 AP=UP+D:C1=0:GOTO 115
DC 110 IF AT=0 THEN RETURN
FI 111 AT=AT-1
IP 112 POSITION 34,0:? "  {2 LEFT}";AT
       ;:IF AT<10 THEN ? "{R}"
DL 113 D=D2(J2):JC=C2(J2):GOSUB 200
HH 114 C1=2:AP=U2+D
```

Typing Olympiad

All three versions of "Olympiad" make extensive use of keyboard graphics in drawing the arena display. To avoid confusion and possible typing errors, please refer to the article "How To Type COMPUTE!'s Programs" before you attempt to enter these programs.

For the 64 version (lines 3010–3220) and VIC version (lines 3010–3210), pay close attention to the places where program lines are divided on the page. If any spaces are to be left after the characters on one line of the page, the correct number of spaces will be indicated in braces at the beginning of the next line. Unless you are specifically instructed to type spaces, do not do so. For example, in the statement below there should be no spaces between the SHIFTed characters on the first line and the cursor lefts at the start of the second, and only four spaces (as specified in the braces) should be typed between the SHIFTed characters at the end of the second line and those at the beginning of the third.

```
400 PRINT"-{R}JCCCCCK{2 SPACES}JCCCCCK
    {6 LEFT}{2 DOWN}JCCCCCCCCCCCK
    {4 SPACES}JCCCCCK";             :rem 128
```

In the Atari version, many special graphics characters are used in lines 3010–3240. Be sure you understand how to type these before you start. In particular, the vertical bar character (|) used frequently in these lines is obtained by pressing the SHIFT and = keys simultaneously.

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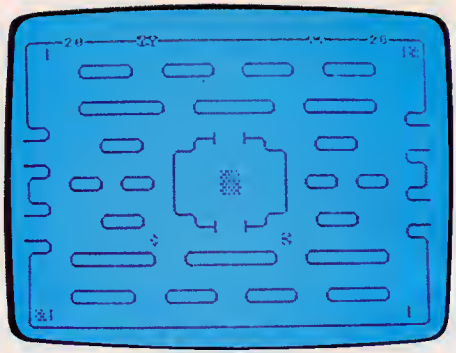
```
0E 115  AO=JC+B:IF PEEK(AP)<>B THEN RET
        URN
16 120  FOR A=1 TO 15:FOR AA=1 TO 5:NEX
        T AA:NP=AP+D:IF PEEK(NP)<>B THE
        N 300
LB 140  SOUND 3,10,B,7:POKE AP,B:PDKE N
        P,AO:AP=NP:NEXT A:SOUND 3,0,0,0
        :POKE AP,B:RETURN
B0 200  IF O<>0 THEN RETURN
LJ 210  IF JC=99 THEN O=-40:RETURN
KM 220  IF JC=100 THEN O=40:RETURN
IH 230  IF JC=9B THEN O=-1:RETURN
NP 240  IF JC=103 THEN O=-41:RETURN
LJ 250  IF JC=102 THEN O=39:RETURN
FM 260  IF JC=97 THEN D=1:RETURN
OH 270  IF JC=101 THEN O=-39:RETURN
JK 2B0  O=41:RETURN
PJ 300  SOUND 3,0,0,0:POKE AP,B:IF (PEE
        K(NP)<97 DR PEEK(NP)>116) AND P
        EEK(NP)<205 THEN RETURN
JO 305  IF NP<CK THEN RETURN
MJ 310  IF C1=0 THEN 330
AL 312  POKE LB,B2:LB=L8+1:F8=FB+1:GOSU
        B 600
BE 314  IF FB=3 THEN 6000
DL 317  GOTO 34
DO 330  POKE LR,B2:LR=LR+1:FC=FC+1:GOSU
        B 610
BJ 335  IF FC=3 THEN 6010
DH 340  GOTD 34
LO 400  NA=20:AT=20:PDSITION 17,4:? " E
        [illegible] ";RN:RN=RN+1:POKE 752,1
CG 405  POSITION 4,0:? NA:POSITION 34,0
        :? AT
MM 410  POKE PEEK(B8)+PEEK(89)*256+959,
        1:RETURN
LB 600  OP=UP:OM=U2:GOTD 620
KH 610  OP=U2:OM=UP
CD 620  POKE AP,B:POKE DM,B:FDR K=115 T
        O 113 STEP -1:POKE DP,K:FDR H=1
         TD 50:NEXT H:NEXT K
AA 630  PDKE OP,116:GOSUB 7000:POKE OP,
        B:POKE UP,8:POKE U2,B:RETURN
FD 1000 REM CHR. SET LDADER
KB 1010 PDKE 752,1:PDSITIDN 3,2:? "LOA
        OING CHARACTER SET INTO MEMDRY
        ."
HE 1020 CHSET=(PEEK(106)-B)*256:FDR I=
        0 TO 1023:POKE CHSET+I,PEEK(57
        344+I):NEXT I
EG 1025 ? "{CLEAR}":POSITION 8,2:? "RE
        DEFINING CHARACTER SET":RESTOR
        E 1045
NF 1030 READ A:IF A=-1 THEN RETURN
CH 1035 FOR J=0 TO 7:READ B:PDKE CHSET
        +A*8+J,B:NEXT J
MC 1040 GOTD 1030
GO 1045 OATA 1,24,24,56,240,192,0,0,0
MN 1050 OATA 5,24,24,12,15,3,0,0,0
HE 1055 OATA 3,0,0,0,192,224,4B,24,24
JO 1060 OATA 4,0,0,0,3,7,12,24,24
HM 1063 DATA 97,102,227,241,159,159,24
        1,227,102
JB 1065 DATA 9B,102,199,143,249,249,14
        3,199,102
BJ 1067 OATA 99,126,219,153,24,60,231,
        231,126
DK 1069 OATA 100,126,231,231,60,24,153
        ,219,126
MG 1070 DATA 101,60,6,207,253,201,201,
        124,60
OB 1072 OATA 102,60,62,147,147,191,243
        ,96,60
OJ 1074 OATA 103,60,96,243,191,147,147
        ,62,60
MP 1076 DATA 104,60,124,201,201,253,20
        7,6,60
NN 1078 OATA 105,0,132,66,63,66,132,0,
        0
KH 10B0 OATA 106,0,33,66,252,66,33,0,0
CF 10B5 OATA 107,16,56,84,16,16,16,40,
        6B
CC 1090 OATA 10B,6B,40,16,16,16,16,B4,
        56
JD 1095 OATA 109,7,3,5,8,16,224,32,32
HH 2000 DATA 110,4,4,7,8,16,160,192,22
        4
NJ 2010 OATA 111,224,192,160,16,B,7,4,
        4
HC 2020 OATA 112,32,32,224,16,8,5,3,7
MD 2030 DATA 113,0,0,B,16,4,16,0,0
CA 2040 OATA 114,0,0,20,10,32,20,0,0
AL 2050 OATA 115,68,9,32,132,1,40,130,
        17
FK 2060 DATA 116,0,0,0,0,0,0,0,0
GH 2065 OATA 6,204,204,51,51,204,204,5
        1,51
EB 2070 DATA -1
EL 3000 POKE 712,152:POKE 710,152:POKE
         709,144:POKE 559,0
JG 3010 ? "{3 R}  {4 R}ddd{14 R}ccc
        {4 R}  {3 R}#";
JJ 3020 ? "I I{34 SPACES}I&I";
LI 3030 ? "I{4 SPACES}${4 R}#  ${4 R}#
        ${4 R}#  ${4 R}#{4 SPACES}I"
        ;
LF 3040 ? "I{4 SPACES}%{4 R}!  %{4 R}!
        %{4 R}!  %{4 R}!{4 SPACES}I"
        ;
HO 3050 ? "I{3B SPACES}I";
LM 3060 ? "I{4 SPACES}${7 R}#  ${7 R}#
        ${6 R}#{4 SPACES}I";
JF 3070 ? "I{4 SPACES}%{7 R}!  %{7 R}!
        %{6 R}!  ${R}!";
CM 30B0 ? "%{R}#{34 SPACES}%{2 R}";
DJ 3090 ? "{2 R}!{4 SPACES}${3 R}#
        {4 SPACES}${R}{D}  {A}{R}#
        {4 SPACES}${3 R}#{7 SPACES}";
HD 3100 ? "{7 SPACES}%{3 R}!  ${R}!
        {6 SPACES}%{R}#  %{3 R}!
        {4 SPACES}${2 R}";
BM 3110 ? "{2 R}#{11 SPACES}I
        {10 SPACES}I{11 SPACES}%{R}#";
```



"Olympiad," Atari version.

```
EH 3120 ? "${R}! ${2 R}# ${2 R}# !
        {4 SPACES}&&{4 SPACES}! ${2 R}
        # ${2 R}#{3 SPACES}!";
EE 3130 ? "!{3 SPACES}%{2 R}! %{2 R}!
        !{4 SPACES}&&{4 SPACES}! %{2 R}
        ! %{2 R}! ${R}!";
CB 3140 ? "%{R}#{11 SPACES}!{10 SPACES}
        {11 SPACES}%{2 R}";
HH 3150 ? "{2 R}!{4 SPACES}${3 R}#  %
        {R}#{6 SPACES}${R}!  ${3 R}#
        {7 SPACES}";
DH 3160 ? "{7 SPACES}%{3 R}!
        {4 SPACES}%{R}{D}  {A}{R}!
        {4 SPACES}%{3 R}!{4 SPACES}$
        {2 R}";
CK 3170 ? "{2 R}#{34 SPACES}%{R}#";
LG 3180 ? "${R}! ${7 R}#  ${8 R}#  $
        {7 R}#{3 SPACES}!";
QB 3190 ? "!{3 SPACES}%{7 R}!  %{8 R}!
        %{7 R}!{3 SPACES}!";
HL 3200 ? "!{38 SPACES}!";
NM 3210 ? "!{3 SPACES}${5 R}#  ${4 R}#
        ${4 R}#  ${5 R}#{3 SPACES}!"
        ;
NJ 3220 ? "!{3 SPACES}%{5 R}!  %{4 R}!
        %{4 R}!  %{5 R}!{3 SPACES}!"
        ;
JM 3230 ? "!&!{34 SPACES}! !";
FI 3240 ? "%{38 R}";
GO 3245 POSITION 0,0:POKE 559,34
DH 3250 POKE PEEK(88)+PEEK(89)*256+959
        ,1
KL 3260 RETURN
OI 4000 IF PEEK(UP)<>6 THEN UP=OP:RETU
        RN
HO 4010 RF=INT(RND(1)*959)+PEEK(88)+PE
        EK(89)*256:IF PEEK(RF)<>8 THEN
         4010
LJ 4020 UP=RF:POKE UP,8:MP=UP:JP=JV:GO
        SUB 5000:RETURN
JP 4100 IF PEEK(U2)<>6 THEN U2=O2:RETU
        RN
FI 4110 R2=INT(RND(1)*959)+PEEK(88)+PE
        EK(89)*256:IF PEEK(R2)<>8 THEN
         4110
CI 4120 U2=R2:POKE O2,8:MP=U2:JP=J2:GO
        SUB 5000:RETURN
MG 5000 FOR MN=113 TO 115:POKE MP,MN:F
        OR W=1 TO 25:SUUND 3,W+50,10,9
        :NEXT W:NEXT MN:POKE MP,CS(JP)
        :SOUND 3,0,0,0:RETURN
GC 6000 WN$=" RED":LS$=" BLACK":T1=4:T
        2=4:GOTO 6020
CI 6010 LS$=" RED":WN$=" BLACK":T1=3:T
        2=5

NM 6020 ? "{CLEAR}":POSITION T1,1:? "T
        HE";WN$;" KNIGHTS WERE VICTORI
        OUS"
MD 6030 POSITION T2,4:? "THEY DEFEATED
         THE";LS$;" KNIGHTS"
QO 6040 POSITION 14,7:? "IN ";RN-1;" R
        OUNDS"
MC 6050 POSITION 4,19:? "PRESS <<SPACE
        BAR>> TO PLAY AGAIN"
CD 6055 POSITION 7,22:? "PRESS ANY OTH
        ER KEY TO END"
OP 6060 GET #1,I:IF I=0 THEN 6060
JI 6070 IF I=32 THEN POSITION 0,0:POKE
         756,CHSET/256:GOTO 4
GE 6080 CLOSE #1:GRAPHICS 0:END
LC 7000 SOUND 3,80,8,15:SOUND 2,100,7,
        12:FOR I=1 TO 250:NEXT I:SOUND
         2,0,0,0:SOUND 3,0,0,0:RETURN
KF 8010 DATA 68,12,68,25,81,12,81,25,8
        1,12,81,25
```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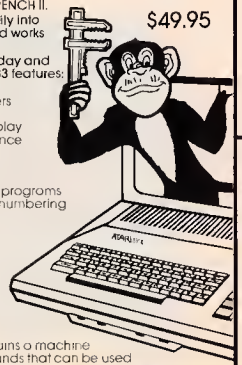

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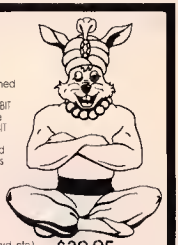

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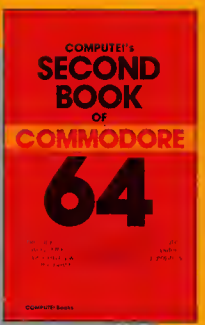

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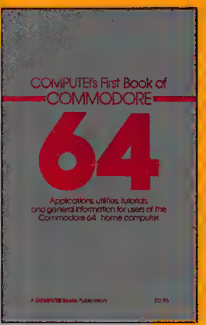

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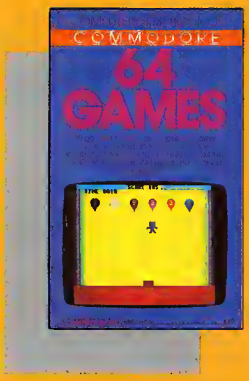

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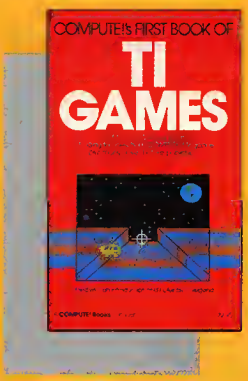

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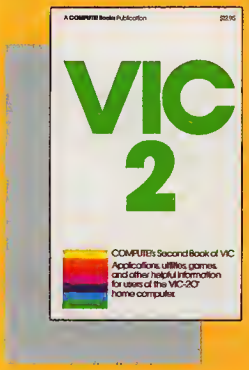

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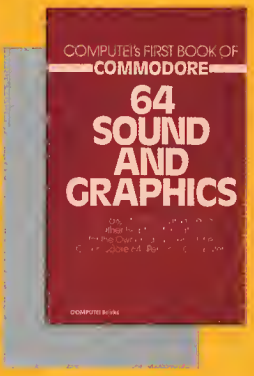

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MailPro

Elizabeth Deal

MailPro, by Pro-Line Software Ltd., is a general filing system for Commodore computers. Versions are available for PETs with 4.0 BASIC as well as the Commodore 64. The Commodore 64 version is reviewed here. I believe that other versions have comparable features.

MailPro works well with *WordPro*, Pro-Line's word processor, and may well be compatible with others, since it outputs normal sequential files.

MailPro on the Commodore 64 uses one 1541 drive and just about any kind of printer. It is up to you to describe the configuration.

A General Data Manager

MailPro is designed to handle mailing lists, but can just as easily handle any kind of information you need to store: catalogs of records or books, bibliographies, student records, or any kind of business files.

The manual is complete. It takes the user from the beginning of setting it all up, through all its variations, to the results. It is both tutorial and descriptive. The only thing I miss in the book is an index of all available keys and functions: A summary would be nice to have. But a list of contents is clearly shown up front, so finding information is not difficult.

The best illustrations are at the end of the book, where a complete example is thoroughly worked out. If anything is unclear in the manual, it becomes easily understood when you go through that example.

MailPro is a pleasure to use. The screen prompts are well done, and it is difficult to botch a job—the computer helps you while you're creating and retrieving files. Setting up the original file is easy; just specify what sort of information will be stored: alphabetic, numeric, yes-no type, sorted, not sorted, etc. The maximum length of each variable is specified next, and so on; you design the screen as you go along. The screen can scroll sideways if any field is larger than 40 columns.

Simple Data Entry

Entering the information is simple, too. Cursor keys act as they normally do on the Commodore computers, with some elaborations. For example, you can jump from field to field easily by using the cursor keys. You can edit the information, and easily abort any function.

Mailpro permits manual entry. It also works with existing files, and allows the user to combine the two processes to manually fill in missing information during file entry. It's a well-thought-out, flexible system.

In addition, *MailPro* can process an existing *WordPro* sequential file. This worked very well in my PET-64 system. *MailPro* just gobbled up the whole *WordPro* file in no time, filling in the variables I defined. The computer did all the tedious work a million times faster than I could have.

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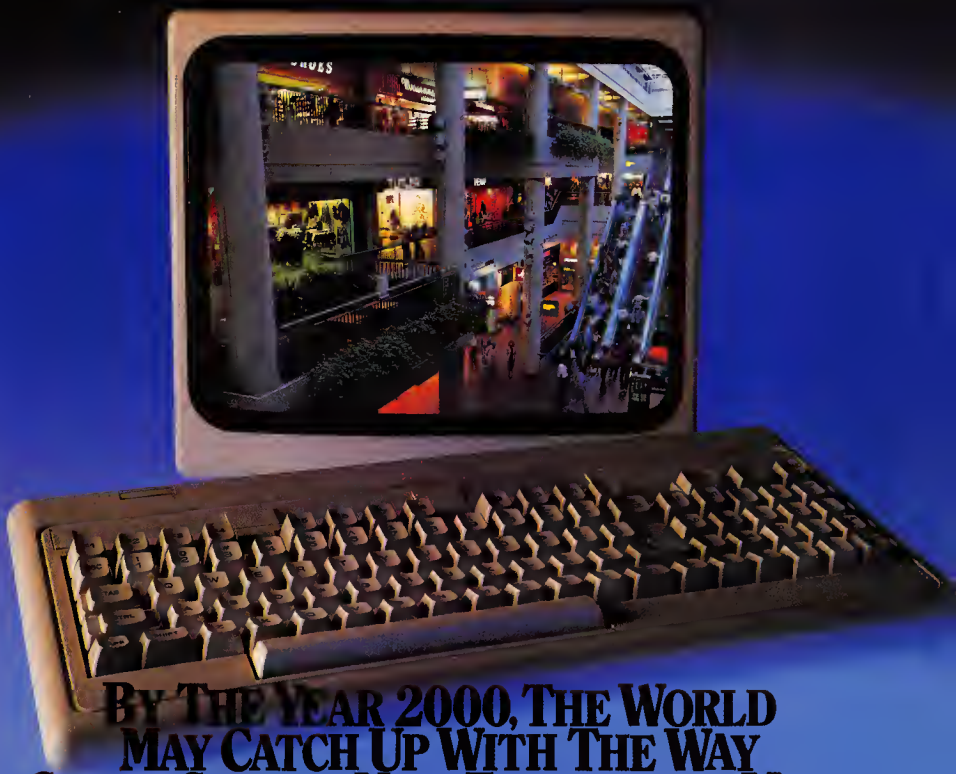

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Excellent Search Features

Retrieving information by a selected name, number, or category is easy and fast. Retrieval can be keyed to one or more variables at a time, and ranges can be set up. You may ask for information that falls within or outside a certain range of values (who hasn't paid my bills? who owes between $50 and $100?).

Changing information also is easy. You can add records at any time, of course, and change the information in existing records.

For straightforward data retrieval, use the screen. If you ask for JONES, all the records (one at a time) containing JONES are displayed. You can ask to go forward or backward in the file, of course.

Fancier retrieval involving complex search criteria can be performed on the printer (or disk). Here you define the output format. It can be a simple list, or it can be a fairly complex report with headings, paging, and extra text.

A Report Generator

The versatility of the system really shows up in the report generator. Instructions for producing reports take up about half of the entire manual.

MailPro writes relative files. The total record length can be 254 bytes; the total number of records on one 1541/4040 floppy is over four thousand. A batch of 127 records can be entered at one time, and the information is sorted during entry. It's a complex system of sorting, and an elegant one, with unlimited key fields. The manual warns that the original sort can take quite awhile, but I haven't run into any serious time delays yet.

Several files are set up, including descriptive files of each field, field sort information, and, of course, the data you enter. In addition, there are output de-

scriptor files, which allow the user to define and redefine up to ten different output formats (printer or sequential disk files). The output format files are of the USR type, but they are created as normal files, so that the disk VALIDATE (COLLECT in BASIC 4.0) does not erase them.

File Conversion

The relative files can be read by *MailPro*, but the program can output sequential versions of those files. They can contain all of the original information (in sorted order on the variable of your choice) or any selected portions of it—perhaps only addresses of people who live in a certain zip code area. Those files can then be easily read from another program such as *WordPro* or a BASIC program of your own making.

MailPro's main options include looking at the disk directory of existing files, creating new files, editing field names, adding records, recalling them, entering new records (manual or merging), and printer or disk output.

The editor options include use of the cursor keys and function keys.

To create a new file, these options are available: specifying number of fields, their sizes (maximum 99 characters per field), and type (alphabetic, numeric, yes/no, sorted/unsorted, etc.).

File Management

To manage an existing file, you can display and print a record, change the information, delete a record, and add records, in a variety of ways.

To specify how a final report is to look, you can ask for a simple listing of everything on a file (such as mailing labels) or you can ask for output of records that match specific criteria. The formatting features include right and left justification, aligned decimal output, compressed output (no spaces), page headings, page numbering, overall margins, sequencing, and tabbing. Print formats can be stored for later use, and up to ten can be defined. They can be redefined at any time. The existing screen image can be dumped to a printer at any time.

Overall, *MailPro* is fairly easy to set up, use, and maintain. It permits easy report generation. It is flexible for use with any kind of data. The sequential files written by *Mailpro* can be read into *WordPro* or used as standalone files for other systems. The disk management is excellent, errors are trapped, and the files can be copied or duplicated by normal procedures. The whole system is solidly built. If you need a versatile data manager, this one is worth looking into.

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Promenade EPROM Programmer For VIC And 64

Sheldon Leemon

Most computer users would agree that cartridge-based software, which plugs right into the computer and is ready to run instantly, is the most convenient to use. In order to create software cartridges at home, however, you need a machine to store programs on EPROM (Erasable, Programmable Read Only Memory) chips.

Some EPROM programmers are difficult to use or prohibitively expensive. One notable exception is the Promenade from Jason-Ranheim. Most programmers in its under-$100 range are little more than bare circuit boards which may be difficult to install. The Promenade, however, is a professional-looking unit which comes in a compact aluminum case approximately 4½ inches square.

It plugs directly into the user port on the back of the VIC or 64, and since it takes all of its power directly from the computer, no other connections are necessary. On the top of the case is a high-quality Zero Insertion Force socket. There are also three colored LEDs, which indicate when the unit is receiving power, when the socket is activated, and when actual programming is taking place.

Versatile Programmer

Its performance is even more impressive than its looks. Most programmers in its price range will only program a few lower-capacity EPROMS such as the 2716 or 2732 types. Others require that "personality modules" be added for each additional EPROM type. The Promenade, however, has several different programming voltages available under software control, so that it can program almost any type of EPROM OR EEPROM now available.

The *PROMOS 1.0* programming software, which accompanies the programmer, adds several new commands to BASIC. These commands are used to transfer data between the computer and the EPROM in the Promenade's socket. Besides being convenient to use, these BASIC commands offer several "smart" programming methods. This means that instead of taking seven minutes or more to program an 8K 2764 EPROM, the Promenade may be able to finish the job in eight or nine seconds.

The only part of this package that is less than first-rate is the instruction manual. Though adequate for the more experienced programmer, it is probably too brief for the total novice. Update sheets have recently been sent to registered owners, however, giving step-by-step instructions for saving BASIC and machine language programs on autostart cartridges. Further revisions of the manual are on the way.

Besides offering Promenade programmer, Jason-Ranheim also sells an assortment of blank EPROMS and cartridges.

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Stickybear

Larry Ross

There has been a sudden increase in educational software for preschoolers and young children. Much of this software has been created to fill a gap, but cannot really be considered quality products. The Stickybear series, however, is an exception.

Stickybear ABC and *Stickybear Numbers* are educational programs designed for children ages three to six. *Stickybear Bop* is a game that the entire family can enjoy. All three programs emphasize graphics, sound, and simplicity. There are no menus or screen directions to deal with. The operation is straightforward. They are available for the Apple II or II+ with 48K and one disk drive (DOS 3.3).

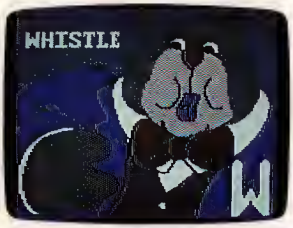
Stickybear ABC

Stickybear ABC is designed so that even a three-year-old can operate it. The child simply presses a letter, and a beautifully animated high-resolution picture, complete with sound effects, appears on the screen. When the same letter is pressed again, a completely different picture appears.

The screen display features a large version of the letter which is selected. A word beginning with this letter is shown in uppercase.

The main objective of the program is to introduce the letters of the alphabet to the user and illustrate words beginning with these letters. In addition to this, *Stickybear ABC* is a thoroughly enjoyable way to accustom children to a computer. A basic introduction to the keyboard is also provided.

Stickybear ABC is part of a complete package. It is accompanied by *The Strawberry Look Book* by Richard Hefter, the creator of Stickybear and the illustrator of each of the Stickybear programs. This book is an account of what the bears see when they go shopping. The name of each item is printed next to it. The package also includes a direction card, a poster depicting each letter as it is shown in the program, and a sheet of Stickybear stickers.



A bear blowing a whistle is one of the displays that appears when a child using Stickybear ABC *presses the W key.*

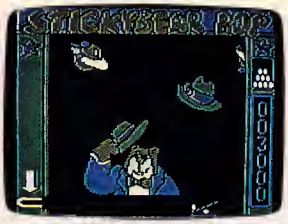
Stickybear Numbers

Stickybear Numbers graphically illustrates the numbers from 0 to 9. Here, too, operation is simple and the graphics and sound are excellent. The child can operate the program either by pressing a number or the space bar. Each time a number is selected, it is animated. The animations range from Stickybear scooping up sundaes to penguins jumping out of the water onto ice. As each number is pressed, a different picture appears. The pictures are randomly selected by the computer.

If the space bar is chosen instead of a number, the animation process is different. The first time the space bar is pressed, the number one is illustrated. The second time, one more object appears on the screen in the same setting until nine objects are finally depicted. Pressing the space bar after this point results in one object at a time being erased from the screen until no objects appear. This completes a cycle and another press of the space bar randomly accesses a

Stickybear puckers up to kiss his mate when the K key is pressed in Stickybear ABC.

Stickybear Numbers *graphically illustrates the numbers from 0 to 9. Here, Stickybear is about to eat 5 ice cream sundaes.*



In Stickybear Bop, *the player uses a paddle or joystick to launch a ball that knocks out the objects Stickybear juggles.*

new animation and starts the procedure over again.

Stickybear Numbers is also part of a complete package which features a direction card, the *One Bear, Two Bears* number book by Richard Hefter, a Stickybear number poster, and a sheet of Stickybear stickers.

Stickybear Bop

Stickybear Bop is the game program in the Stickybear series. With a shooting gallery theme, the game opens as a large, smiling Stickybear moving slowly by, tipping his hat. At the same time, planets, ducks, and hats pass above him. The object of this round of the game is to "bop" ten objects off the screen using the flipper and ball which are positioned at the bottom of the screen. The player is supplied with ten balls. Each time an object is missed, the player loses a ball. The game ends when all ten balls have been used.

There are six rounds, each with different graphics. As objects are "bopped" off the screen, points are awarded and recorded in the score box. If a player is able to finish round six, there are still additional items to be bopped and the game continues.

While the game is designed for the whole family, young children will find round two to be difficult, though rewarding. Time and practice will help them improve. This is a good game to play as a family.

The graphics and animation are as appealing in *Stickybear Bop* as they are in the other two Stickybear programs. The program package includes a direction card, a poster of Stickybear, a Stickybear sticker sheet, and a Stickybear Bop game.

All three programs demonstrate their creators' awareness of what appeals to children. Also, there appears to be a commitment to introducing the computer to children cleverly, enjoyably.

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Two Games Of Strategy

Dale F. Brown

Avalon Hill has produced several high-quality strategy computer games that should challenge and interest nearly everybody. These games are written in BASIC—proof that fast-action, nerve-tingling computer games can still be written without machine language.

Computer Football Strategy

When my TV isn't doing word processing with the computer, it's usually tuned to a football game, so naturally the first Avalon Hill game I picked was *Computer Football Strategy* for the Commodore 64. The game display shows the football field as a small, thin strip divided with ten-yard lines. While you are playing, four graphics characters (two for the offense and two for the defense) run back and forth on the field with the ball. It has no resemblance whatsoever to a real field, and it's not designed to simulate a real game. A field with X's and 0's would have been more useful.

Above the field are the game statistics and scoreboard information. Below it are the displays showing the offensive and defensive play options. (You can play the computer, play another person, or have the computer play itself.) Each side picks either an offensive or a defensive play, and the ball advances depending on the plays called.

Each player has a playbook with all of the possible offensive plays paired with all the possible defensive plays, showing their outcomes. The offensive play has a certain amount of time built into it (it is not a realtime game), so you can either take

the play or call a time-out and call another play.

The most impressive feature of this game is the numerous offensive and defensive options available. As quarterback, you can call 20 different plays from scrimmage, and depending on the defensive alignment, there can be ten different outcomes to each play. If you truly get into realistic role-playing in this type of game, you can re-create an actual football game with surprisingly accurate results.

However, I was expecting to watch my quarterback drop back to pass, watch my receivers run their button-hooks or down-and-ins, or watch my linebackers do their inside blitz, but the display doesn't show any of that. Also, some of the plays take some time. A sideline pass for a short 5- or 10-yard gain sometimes takes 10 to 15 seconds, and there are no hurry-up offenses. The game might be more realistic if more clock control were allowed.

This game is best when you play another person, rather than the computer. Maybe it's just sour grapes, but I seemed to get more penalties and fewer touchdowns while playing the computer. I always do better against a human opponent.

Take To The Skies

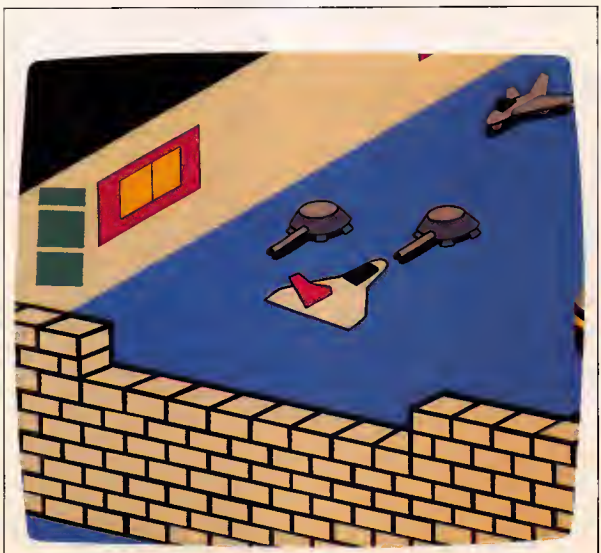
If I rated *Computer Football Strategy* as *good*, Avalon Hill's *B-1 Nuclear Bomber* rates a solid *better*. In *B-1 Bomber*, you are the captain of a supersonic bomber on airborne alert. As the game begins, you receive a message containing a fail-safe arming code, your primary target, a list of alternate targets, and a longer list of enemy defense complexes that can be targets for one of your six multipurpose Phoenix missiles. Your job is to fly your plane to the target of your choice, evading or countering the defenses along the way, and launch your single Short-Range Attack Missile (SRAM) at the target.

At the beginning, the game is agonizingly slow. Even flying at 4500 kilometers per hour, it will take you several minutes of simple droning to even get within range of a defense complex that may take any action against you.

Here's where the strategy comes in. You can attack any target on the list with your SRAM, and you can launch your Phoenix missiles at any defense complex in range. This means you can attack a base, then turn around and head for home before too many attackers find you. You can choose to fly around the enemy defense bases, or attack them head-on. You can launch your missiles at attacking fighters, or save them for the bases. Will you run out of missiles before you get to the enemy bases, or will you try to save the missiles and rely on electronic countermeasures (ECM, or jamming) and violent evasive maneuvers to defeat the enemy fighters and surface-to-air missiles?

The action in the target area more than makes up for the long minutes of boredom flying towards the target. Once you reach the target area, you enter the fail-safe code to arm the attack missile. Here's where the action really begins. Arming the SRAM acts like a beacon to the enemy, saying "Hey! Here I am!" Soon, your screen fills with attackers. Each radar search tells you what kind of threat is attacking and how long it will be before it attacks. If you've used too much ECM before now, it becomes less and less effective. Evasive maneuvers start to use up more and more fuel and place you closer and closer to the ground.

The back of the game manual has a map of the targets and defense complexes. The computer will give you a heading toward any base you select, but you must put in your own head-



ZAXXON

ings if you've run out of missiles and don't want to overfly a defense complex. A heading of 90 is east (right), 180 is south (down), etc.

The cockpit display is rather disappointing. There is a graphic depiction of a bomber cockpit, with a control column and throttles, but they don't really do anything and are a little distracting; some cockpit gauges or a simple route map might have been more interesting. The very bottom of the display shows present course, fuel, missiles remaining, speed, and primary target, but they're hard to read and hard to understand. The commands for navigation, defensive measures, and launching missiles are easy to understand, though.

Again, the game is not in realtime. Each command takes a certain amount of preprogrammed time, so an evasive maneuver command may not have enough time to be fully executed before an attacking missile explodes in front of your plane. It takes a little practice to get the timing down, so eventually you'll know what to do when the computer says, "a Mig will intercept in 32 seconds!"

In *B-1 Nuclear Bomber*, you can take advantage of the fact that these games are written in BASIC. Do you think six Phoenix missiles are too few for a beginner? Is 4500 kilometers an hour too slow? Is 24,000 pounds of fuel to start too little? A little poking around the program can change those parameters until you get more familiar with the game.

These two games are available for most popular microcomputers at prices ranging from $16 for tape to $21 for disk.

Computer Football Strategy
B-1 Bomber
The Avalon Hill Game Company
4517 Harford Rd.
Baltimore, MD 21214

Operation Whirlwind

James V. Trunzo

Operation Whirlwind, by Bróderbund, is a new and unique computer war game for the Atari 400/800/1200 computers. Bróderbund, heretofore better known for their superior arcade games and more recently their word processor, *Bank Street Writer*, has released a World War II strategy game that is in many ways, an original.

Computer war games usually bring to mind endless hours of tedious movement and even more tedious perusing of a book-length set of instructions. *Operation Whirlwind*, however, is simple to play, yet authentic and challenging.

All The Classic Moves

Operation Whirlwind, while not based on any specific battle or operation, adheres to all the subtleties that go into a first-class war game.

Terrain, movement, firepower, range, line-of-sight, and unit disorganization are all incorporated into the game without the usual burden of a multitude of charts and tables.

The sequence of play for *Operation Whirlwind* consists of one turn broken into five distinct phases, each activated with a joystick and, on the Atari, the yellow function buttons. No keyboard input is required during any phase of the game.

The first phase is the Command Phase, during which you can either order your units to dig in or keep them combat-ready. A unit that has dug in regains lost combat strength through reorganization and rest. They can defend their positions, but they cannot assault a position or move. Like all orders throughout the game, you give a combat-ready or dig-in order by placing a hollow square cursor over a unit and pressing the joystick button.

Armies On The Move

The second phase is the Movement Phase. Use the joystick to place the cursor over a unit, then press the joystick button to begin the unit's movement. Movement must be either horizontal or vertical. Movement rates vary, depending upon unit type, terrain being traversed, and remaining unit strength. Movement can also be halted by severe enemy fire or by damage from hitting mines.

It should be noted that an enemy unit is invisible until it is spotted by your recon units or it fires on your units. Mines are never visible.

Movement is completed by pressing the fire button again and releasing the piece. You can move all, some, or none of your units each Movement Phase, and each unit can move its entire allotment or only part of it.

Using all of a unit's movement allotment, however, prohibits it from firing during the turn. To indicate that you are approaching total depletion of activity points, the cursor turns red.

Combat Is The Action Phase

The third phase is the Combat Phase. Unseen enemy artillery starts to shell your troops, and sighted enemy units also open fire. To return fire, place the cursor over the unit which is to fire and press the fire button.

The cursor turns into a blinking cross hairs which you then move from the firing unit to its target. Press the fire button again to activate the shot. Several things can occur at this time: 1) You can score a hit (don't count on any single hit taking out an enemy unit); 2) you may get a message indicating that the target is out of your range; or 3)

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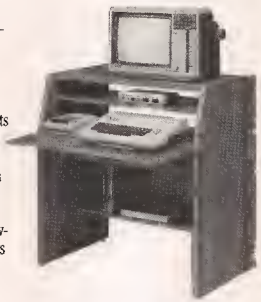

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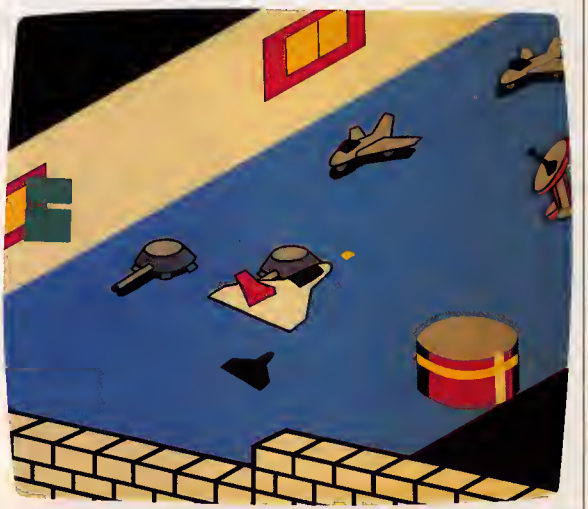

you may get a message indicating that your line-of-sight is blocked. The number of shots each unit receives is determined by how much movement it did prior to the combat phase.

Assault Order Phase

The fourth phase is the Assault Order Phase, during which units with activity left (those not using it all during the movement and combat phases) can assault enemy units adjacent to their positions. Assaults, or overruns in the case of tanks, are devastating attacks, but they also inflict many casualties on the attacking units.

Assault orders are used for a second important purpose. There are two rivers that must be crossed before getting to the occupied city. To cross them, your engineer units must build new bridges. This is handled by placing an engineer unit next to the river and giving it an assault order. All orders are given via joystick, with the cursor turning into an arrow to show the direction of the assault.

The fifth and final phase is the Assault Phase. All assault orders given in phase four are carried out during this phase, though not always successfully. It might, for example, take several turns to build a bridge or dislodge a strong defending enemy unit.

At the end of this phase, enemy units may move, either in retreat or simply in an attempt to fortify their defensive positions. They will fire a parting shot at any unit in their range as they go.

To get from one phase to the next, use the yellow function keys. Press the START key whenever you wish to move from one phase to another, and you are on your way.

This description of the phases is simplified. Much strategy and planning are involved in all areas, and there are many programming niceties such as cursors changing color to indicate that various events have occurred during the game sequence.

Assessing The Action

When you have completed all five phases, you have completed one turn. You will be informed of your chances for victory (doubtful, marginal, tactical, etc.), and you will be asked whether or not you wish the game to be saved before starting the next turn. Saving (and reloading) a game is accomplished with the yellow function keys. Games may be saved to either the master disk or to a formatted, unused data disk.

The game has four difficulty levels. In addition, each level of difficulty can result in one of five levels of victory or defeat. Furthermore, the computer-controlled German forces will randomly employ one of four different strategies to add to the

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Operation Whirlwind has excellent sound effects and a good graphics rendition of typical war-game unit and terrain symbols. Even when viewed on a television instead of a monitor, the symbols are sharp, making unit identification easy.

The cursor movement and scrolling are smooth, which is important because the battlefield is about three television screens wide.

Operation Whirlwind differs from some other war strategy games in that it concentrates on a single, ongoing battle with a single, well-defined objective rather than trying to simulate a far-flung campaign. Just as you are celebrating your conquest of the German-held city, you are greeted by the sounds of the marching units that make up the unrelenting German counterattack.

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The Morning After:
Anti-Computer Backlash And The Arrival Of The Mass-Market Home Computer
Part 2

In this month's column, we conclude the text of Fred's speech at the West Coast Computer Faire. Part 1 appeared last month.

A Failure To Explain Computers

What could make computers go out of style? What could make the market for home computers dry up?

First, the personal computing revolution is already nine years old, yet the revolution's leaders (computing educators, manufacturers, authors, journalists, and spokespersons) have still not succeeded in explaining computers to the average person. Underneath the surface, the average person remains just as fearful, just as ignorant of computers as he was nine years ago.

Second, the computer industry has persisted in focusing on hardware and high technology instead of on human beings and human needs. Computers and computer programs have evolved based on their own logic and strengths rather than on human nature and human psychology. Most of the industry's imagination has gone into making the computer a gaudy "show-off" machine rather than on tailoring the computer to average human beings who want only to think like human beings, work like human beings, and have fun like human beings, *and not like computers.*

We need a new generation of computer programs which reflect the workings of the human mind. We have had enough computer programs that put human minds on the rack and try to squeeze them and stretch them to become more computerlike.

A Wellspring Of Resentment

Last, the computer industry, in its well-founded enthusiasm and zeal, has not been completely honest. Advanced computer applications are shown regularly on TV commercials. The average consumer sees these commercials, so he thinks that his $50 computer will be able to do something similar. His expectation, of course, is absurd. But it is creating a huge wellspring of resentment and disappointment among disgruntled consumers who discover that their low-cost home computer cannot perform the miracles that computers in TV ads commonly perform.

Educational Advertisements

Manufacturers should respond quickly and directly to this growing consumer backlash to computers by beginning a series of educational advertisements on TV and in the other media. For purely commercial reasons, these computer ads should be carefully designed, ongoing tutorials on the fundamentals of computing.

Manufacturers can begin their campaign by showing bare-bones computers. They can explain that low-cost computers are "kits" that require lots of time, effort, and money before they can do anything useful.

In later ads manufacturers can take consumers by the hand and show them how they can put their kits together, how they can "grow" their kits into full-fledged computers, and how they can buy full-fledged computer *systems* outright.

Preventing A Consumer Backlash

To prevent a consumer backlash against com-

puters, manufacturers need to advertise computers honestly; they need to start educating the average consumer. In addition, they need to admit that computer software is far more important than hardware. The simplest, most ugly computer can be a better buy than an advanced computer *if* it comes with good, easy-to-use software.

In addition, manufacturers need to design new computers that are more suitable for the average consumer. Low-cost, bare-bones computers should still be offered. They meet the needs of people and groups who operate on a tight budget. And they are perfect programming laboratories for young people who will become our next generation of software inventors, engineers, designers, artists, and entertainers.

However, manufacturers should also offer higher-priced computer *systems* that come completely bundled with hardware and software. The entry-level computer system should come with at least 256K of memory (for powerful yet simple software), a built-in modem, a disk drive, and a printer. And it should come, at minimum, with a library of software, including a word processor, an electronic notebook, a file cabinet, communications software (a post-office, mailbox, library, telephone program), a spreadsheet program, and a calendar-scheduler program.

Computer systems should also come with a program (like "Apple Presents Apple") that lets the computer introduce itself. And every program on the computer should have the responsibility to teach the new user how it (the program) works.

The First Mass-Market Computer

Into this rapidly evolving market comes the IBM PCjr. This computer arrives at a fateful time. It may well become the catalyst for a new generation of mass-market home computers.

According to many industry experts, the PCjr is something of a disappointment as a computer. *But this is absolutely inconsequential!* From the looks of things, the PCjr will probably still emerge as the standard in the home computer market the way its big sister, the PC, has emerged as the standard in the business market.

The PCjr is attracting third-party software and equipment the way the Apple computer did before it. But there is an important difference: The industry has grown and matured enormously since the introduction of the original Apple computer.

What does this mean? It means that third-party support for the PCjr is materializing much faster than it did for the Apple. It means that, within a year to 18 months, there will be a vast supply of equipment and software for the PCjr. It means that the quality of this equipment and software will be as advanced as anything that is on the market. The guidelines for the best new computer products are *low cost, productivity, friendliness,* and *simplicity.* The products for the PCjr that incorporate these features will be a better buy than older products for home and business computers, products that probably cost hundreds of dollars more.

All these developments will totally transform the PCjr. Within a year after its introduction, the basic PCjr computer will cease to be of any consequence. Instead, all that will matter will be:

- The quality and variety of its third-party software.
- The quality and variety of its third-party equipment.
- The IBM name and reputation for stability and excellence.

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Splitting Into Two Markets

The PCjr, *as a galaxy of hardware, software, and equipment*, will reflect the emerging sophistication of the American consumer. If it is marketed honestly, it may play a major role in educating the American consumer and in combating anticomputer backlash.

The PCjr should be sold at two levels. The less expensive model will appeal to people on a tight budget, to schools and budding computer inventors, and to the computer literates. It is a computer "kit" for people who want to learn more about how computers work or who have to do their computing on a shoestring.

The more expensive model will become the preferred computer of the computer intimates. Computer intimates will choose their computer the way they buy their home stereo. They will purchase the complete computer with all its components and with a library of record albums (software). They will want to take the computer home, plug it in, and let it become the heart of a family work station, communications network, and entertainment center.

A New, Expensive Standard

By mid-1985 the Japanese will be ready to follow IBM into the U.S. home computer market. By then the market will have consolidated, matured, and stabilized to the point where the risk of entering the market will be small and the rewards will be immense.

By mid-1985 a full-blown PCjr, with supporting third-party equipment and a library of software, may well have emerged as the home computer industry standard. But it will be an expensive standard, thus severely limiting the market size.

This is where the Japanese come in with their proven ability to market high-quality, high-technology products at a mass-market price. The Japanese will offer the lower-priced computer "kits," but they will concentrate on mass-marketing complete systems at only a fraction of the price of the PCjr and its clones and look-alikes.

As a result of the entry of IBM, and later the Japanese, by 1986 computers for the first time may become a truly low-cost, mass-market home appliance. Christmas 1986 will be like Christmas 1983, but with Americans buying millions of bundled home computer *systems*.

Software At The 7-11

The biggest revolution over the next three years will not be in home-computing computer hardware or software. It will be in software *distribution*.

Today the computer software industry is a dwarf about to become a giant.

Until now, the software industry's offerings have been narrow, primitive, and far too expensive for mass-market merchandising. The problem has been the medium on which the software is distributed—cassettes, diskettes, or ROM cartridges. The medium was either cheap but slow and inappropriate for large programs (tapes), or fast but too expensive and too limited in memory (cartridges), or fast and spacious but expensive (diskettes).

There are more than 35,000 computer programs on the market, stored on a tape, cartridge, or diskette. But buyers can afford to buy only a few programs apiece because of their high cost, and because there has been no way to evaluate or preview the programs. At the same time, retailers are reluctant to stock a large number of programs because program packages are bulky, and programs have a limited shelf life. (Like records and books, they stay "hot" for only a short time.) The retailers are afraid of acquiring a big inventory of programs that aren't moving.

But the software industry is on the verge of changing—suddenly and explosively. Software manufacturers have now found an amazing shortcut—a new way to distribute their products. Over the next year they will begin distributing software *electronically*. This one change will enable the industry to quadruple itself in under a year's time.

How will software manufacturers manage this miracle?

New *software kiosks* will soon be popping up in all sorts of places, including department stores, stereo stores, toy stores, computer stores, discount stores, and even 7-11s, drugstores, and videogame arcades. The kiosks will feature computer terminals that are capable of running thousands of piped-in programs on all subjects and for all major computers. A powerful "expert system" will guide the average consumer through the myriad choices and help him decide on his next software purchase.

When the consumer is ready to purchase a program, he will place a disk into a slot on the terminal. He will have purchased the disk for about $10. A moment later, software for *his* home computer will be beamed over a telephone link from a mainframe computer to the store's terminal and stored on his disk. He will pay the machine, vending machine style, with a credit card, or make his purchase as he leaves the store. The software itself will cost him only a nominal price—from $5 to $10.

The real savings comes to the consumer (and the real meaning of the revolution emerges) the next time he wants to buy a new program. He returns to the kiosk, picks out a new program, *and has to pay a total of only $5 or $10*. The computer

automatically erases his old program from the disk and replaces it with the new program.

Piping in new programs electronically and reducing the cost of individual programs will turn software into an overnight mass-market industry. And software, of course, must be run on computers.

However, when the electronic distribution of software cranks into high gear, computers themselves will quickly sink into obscurity. The computer industry will become like the record industry, with the real focus not on the hardware but on the software.

In the record industry, the focus is on the hot new *songs*. In the computer industry, the focus will be on the hot new *programs*. Because of their instantaneous, low-cost availability, new programs will be in great demand. The average person will be able to acquire programs almost on a whim, and he or she will be anxiously awaiting all the new programs the moment they come on the market.

A New Synthesis

During 1986 the huge group of computer intimates (people who love to use computers, but don't have the faintest idea how they work) will merge with the much smaller group of computer literates (people who insist on being knowledgeable about the goings-on under a computer's "hood"). As a result of this merger, the home computer market will again be relatively homogeneous and unified.

At that time both groups will realize that the average person doesn't want to buy a computer "kit." But they will also realize that computers can never become black boxes—like toaster ovens or TVs. No matter how friendly the software, no matter how simple computers are to use, computers will still need to be programmed. Programming is an unavoidable part of computing.

But programming, in 1986, will not be equated with learning BASIC or Logo or Pascal. Instead, it will be a more general-purpose discipline of (goal-oriented, problem-solving, and algorithmic) thinking. And it will be practical and *application-oriented*.

Even when people use a friendly, commercial program, they must do some programming themselves. No matter how advanced the program, the computer cannot do everything itself. When people use a word processor, they are programming a document. When they use a data base manager, they are programming their electronic file cabinet. When they dial up CompuServe or the Source, they are programming their electronic telephone, post office, newspaper, catalog, or library. Programming can be easy, menu-driven, and done with icons and mice, but it is still programming. Human beings still have to do some of the work.

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Questions Beginners Ask

Tom R. Halfhill, Staff Editor

Are you thinking about buying a computer for the first time, but don't know much about computers? Or maybe you just purchased a computer and are still a bit baffled. Each month in this column, COMPUTE! *will answer some questions often asked by beginners.*

Q For keeping programs on tape, what's the best kind of cassette recorder I should buy for my computer?

A First of all, be sure you have an option in this area. Some computers require a special recorder and are not designed to work with ordinary cassette recorders. Examples are Commodore and Atari computers. The Commodore 64, VIC-20, and PETs require a Datassette recorder; the Atari 400/800 and new XL models require the 410 or 1010 Program Recorder. These special recorders are optimized for data storage and generally cannot be used for any other purpose. For instance, neither the Commodore Datassette nor the Atari Program Recorders have microphones or standard input/output phono jacks. Instead, they have interface cables which plug into a special port on the computer.

Other personal computers are designed to work with any standard cassette recorder. Examples are the Texas Instruments TI-99/4A, Radio Shack TRS-80 computers, the Apple II, IBM PC/PCjr, and Timex/Sinclair computers.

If you have a computer which can work with a standard recorder, check the manuals to see if the manufacturer recommends a certain brand. Sometimes a recommendation means the manufacturer has experimented with different recorders and has found a particular model to be superior. On the other hand, some manufacturers merely recommend a recorder made by an affiliated company. Radio Shack, for instance, advises TRS-80 owners to buy a certain Radio Shack recorder for their computers.

The best way to get a reliable recorder is to try several different models with your computer and decide for yourself. Unfortunately, you probably won't have access to very many recorders, unless you can find a store which will let you return any which don't work well. Perhaps you can borrow cassette recorders from friends for your tests. Or contact your local users group for advice.

Other than the computer manufacturers' own units, we know of only one recorder specifically made for home computers: the General Electric Computer Program Data Recorder (Model 3-5158A). It looks about the same as any other recorder in its price range (under $40), and even has a built-in microphone for taping voice or music. However, GE says the unit has a flatter bass response for more reliable data recording. It also has two features you should look for in any recorder to be used with a computer—a tape counter and a tone control. Tape counters are invaluable for locating programs in the middle of tapes, and tone controls can optimize the recorder's output for your computer. With any recorder, you should experiment to find the exact volume and tone settings that work best and then mark them for future reference.

Q I've tried to take pictures of my computer screen like the ones I've seen in COMPUTE!, **but they never come out quite right. What's the best way to do this?**

A In the first place, you must have a camera which can focus closely enough to fill the viewfinder with the screen. Most inexpensive cameras cannot focus sharply on objects less than three to five feet away. Inexpensive cameras also have semi-wide-angle lenses which make the image appear even smaller, plus separate viewfinders which do not show the actual image as seen by the lens (and therefore the film). At COMPUTE!, all screen photos are taken with a tripod-mounted 35mm single-lens reflex camera with a 50mm (normal) lens. The camera is positioned so the edges of the screen are just visible at the edges of the viewfinder.

With this setup, only three major problems remain: avoiding reflections, determining proper exposure, and eliminating partial scan lines.

Reflections on the glass video screen are distracting and often show up as "hot spots" in the photograph. Flash pictures, of course, are out of the question. All light for the picture must come from the screen. We avoid reflections by shooting the photos in completely darkened, windowless

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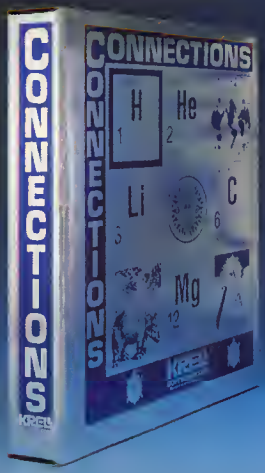

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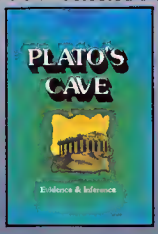

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rooms. At home you'll have to shut off all the lights, pull the window shades and curtains, and close the doors. If this isn't practical, try erecting a blanket "tent" over the camera and screen to block off all outside light.

Unfortunately, darkening the room can complicate the second problem—determining proper exposure. If the camera has a built-in meter, it is fooled by the dark background. We often get around this problem with a handheld light meter, holding it close enough to the screen to make sure it isn't reading anything else. You can do the same thing with your camera's meter, although it means removing the camera from the tripod for each reading. And be sure not to read a completely dark or light screen. Take your readings from medium tones or colors.

The camera must be mounted on a tripod for the exposure because of the very slow shutter speeds required. TV sets and monitors display an image by constantly redrawing it on the screen—about every 1/30 second. Theoretically, then, shutter speeds faster than 1/30 second result in a picture with only a partial screen image (the partial image shows up as a dark band across the screen). In practice, we've found that shutter speeds no faster than 1/4 second are necessary to completely eliminate partial scan lines. And that, in turn, means the image must remain motionless for the duration of the exposure to avoid blurs. We often have to modify programs to freeze them on the screen.

Finally, slow- or medium-speed films are better than fast films. We use Kodak Ektachrome 64 (a color slide film) mainly because it can be custom-processed locally in a few hours. Actually we would prefer Kodachrome or another film with a warmer response to compensate for the strong blues emitted by most video tubes. Our exposures with Ektachrome 64 are usually about 1/2 second at f/16. We bracket one stop each way to insure good results. We also hook up the computer to a regular computer monitor instead of an ordinary TV to get a sharper picture. ©

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THE BEGINNER'S PAGE

Richard Mansfield, Senior Editor

A Wall Of Loops

It takes most people a few weeks of part-time study to learn BASIC. Of course defined functions, multidimensional arrays, and other advanced techniques would not yet be understood, but after a short time, a novice programmer can accomplish a good deal with BASIC.

Nevertheless, during those first few weeks, most of us run into a wall—one of the fundamental BASIC commands is simply beyond understanding. Try as we might, some concept thoroughly resists our efforts to learn it. For me, the wall was the ON X GOTO 100,200,300 command. With furrowed brow, I came back to it again and again, trying to see how X controlled those line numbers following the GOTO.

Simple Loops

Others have said that their wall was *nested loops*. Let's take a look at these loops within loops. Nested loops are one of the elements of computer power and a beginning programmer must be able to use them.

Here's a simple loop:

Program 1: Simple Looping

```
10 FOR I = 1 TO 100
20 PRINT I
30 NEXT
```

The variable I is assigned a range of 1 to 100 in line 10. It is told that it will start out being a 1 and count up to 100 during the FOR-NEXT loop. And any commands between the FOR and the NEXT will be executed *each time* through this loop. In other words, line 20, which prints the current value of I, will be executed 100 times.

Anything else you want done 100 times can be squeezed in between lines 10 and 30 in this program. If you want your name printed 100 times, just put in a line 11 like this:

```
11 PRINT "MY NAME"
```

and it, too, will be printed. It's easy to see how this might come in handy when printing labels or addresses on a printer.

Now, to make the actions in Program 1 a bit clearer, take a look at Program 2:

Program 2: Looping Without FOR-NEXT

```
10 I = 1
20 PRINT I
30 I = I + 1
40 IF I = 101 THEN END
50 GOTO 20
```

This does exactly the same thing as Program 1, but it's a bit clumsy. As you see, we *can* create a loop structure without using FOR-NEXT commands, but it takes up more room, takes longer to program, and runs more slowly. It's not generally the best way to set up loops, but it does help to visualize how a loop actually works.

Stuffed And Nested

Now we can try stuffing loops inside other loops. This is a technique which amplifies the power of loops. It's called *nesting* and the first FOR (coupled with the last NEXT) is called the *outer loop:*

Program 3: Nested Loops

```
10 FOR I = 100 TO 500 STEP 100
20 PRINT
30 PRINTI
40 FOR J = 1 TO 10
50 PRINTJ;
60 FOR T = 1 TO 100
70 NEXT T
80 NEXT J
90 NEXT I
```

The outer loop in this program (the FOR in line 10 and the NEXT in line 90) causes the entire program to cycle five times, executing every command in lines 20–80 five times before stopping. As an aside, the STEP command in line 10 is an interesting variation on the simple I = 100 TO 500 command. Without the STEP, this program would execute 500 times. But STEP forces the I variable to add 100 to itself each time we hit the NEXT in line 90. So, instead of a series like 1,2,3,4,5,6,7 ... we get the series 100,200,300,400,500, a total of five cycles through the loop.

In any case, line 20 PRINTs a blank line, line 30 PRINTs the current value of the I variable, and then we come upon the first nested loop. The J

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variable is given a range of 1 to 10, so everything between lines 40–80 will be performed ten times. But since this loop is nested inside the I loop (which creates five cycles of its own), the PRINTJ in line 50 will be executed 5 *times* 10. In other words, the value of J will be printed a total of 50 times in this program.

An even deeper loop, called the *inner loop*, appears between the FOR in line 60 and the NEXT in line 70. This loop is given a range of 1 to 100, but it isn't given anything to do. It just counts up to 100 and then we perform the NEXT J in line 80.

Do-Nothing Timers

That inner T loop does actually accomplish something, however. It uses up time. Such loops are often called *do-nothing loops* or *delay loops*. Their function is to slow down the computer. Sometimes this is very handy. Computers are fast. If you are having something PRINTed to the screen and it's sliding by too fast to read, insert a delay loop and give that loop whatever range suits your reading speed. Then, before allowing the program to proceed, the delay loop will count from the low up to the high number in its range.

Here is a second version of this same program, but, again, the FOR-NEXT commands are not used. If you are still unclear about how Program 3 functions, take a look at Program 4:

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Program 4: Nested Loops Without FOR-NEXTs

```
10 I = 100
20 PRINT
30 PRINT I
40 J = 1
50 PRINT J;
60 T = 1
70 T = T + 1
80 IF T < > 100 THEN 70
90 J = J + 1
100 IF J < 11 THEN 50
110 I = I + 100
120 IF I = 600 THEN END
130 GOTO 20
```

Like Program 2, Program 4 is large, clumsy, and slow. For example, it takes five times as long to execute as Program 3, its counterpart. You'll probably never write nested loops like those found in Program 4, but you can take a look at it to see how nested loops are structured.

Program 4 also illustrates various true/false types of loop exits. Line 80 means that we keep on cycling through the loop if the variable T does not yet equal 100. We exit when T = 100. Line 100 continues to cycle as long as J is less than 11. In line 120, we exit the loop (and stop the entire program, via the END command) if I equals 600.

Rules And Customs

There are several programming rules and customs you should try to observe when working with loops. In general, a programmer cannot use the same variable name for different functions or the program might make serious errors. For example, if you are writing a program to figure out your budget and you say TAXES = 15000 (for federal tax) and then use the variable name TAXES again later in the program: TAXES = 400 (meaning state tax), you will have hopelessly confused the computer. You have to use different variable names, such as FED and STATE.

The same thing applies to loops. Each different loop must have its own name FOR I/NEXT I, FOR J/NEXT J, etc. To help keep this straight, most programmers use the variable I for their outer loop, then J, then K, and so on up the alphabet. The letters I, J, K, and L *are not used for normal variables*, just for loops. Similarly, the variable name T is reserved for *t*iming loops, those delay loops we mentioned above.

Also, every FOR must have a matching NEXT to close its loop, and nested loops must not interweave. You cannot have a structure like this:

```
10 FOR I=1 TO 10
20 FOR J=1 TO 20
30 NEXT I
40 NEXT J
```

lines 30 and 40 are out of order. The inner loop, the J loop here, must be closed by its NEXT before the I loop can be closed. ©

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Computers And Society

David D. Thornburg, Associate Editor

Until this year, the personal computer industry had been moving steadily forward in the quality and utility of the technology made available to the user.

I remember in 1978 when choices were largely limited to Commodore's black-and-white display of characters (no high-resolution graphics), Radio Shack's black-and-white display of capital letters and limited low-resolution graphics, and Apple's color display with low- and high-resolution graphics, but no lowercase letters.

Over the intervening years, new players like Atari created improved computers with superb sound and graphic capabilities, simply because improving the technology was the way to win new customers. This type of advancement rippled through the early computer manufacturers, leading, for example, to computers like the Commodore 64.

Innovation Meant Profits

It was the American Dream in action. If you wanted to compete in the personal computer marketplace, you had to create better technology so the customer got more perceived value for each dollar spent. The customer *and* the computer manufacturers were clear winners. Each technological advancement sparked new enthusiasm in the marketplace and in the hearts of the designers.

Companies who lacked the vision or the ability to keep in step fell by the wayside, and new companies entered the field knowing they would be judged on technological performance and price. It didn't matter if you were a new company or an old-timer to the industry; the issue was one of performance.

Benjamin Franklin would have been proud.

Enter Big Blue

But then something strange happened. A sleeping giant awoke and entered the personal computer marketplace with a system that would have gathered dust on the shelves had it been created by a small company. Given IBM's newness to the personal computer field, the awkwardness of the PC could perhaps be forgiven.

But, rather than letting IBM take its lumps with the other companies who delivered less than expected, analysts and just about everyone else started jumping on the PC bandwagon. "IBM legitimatizes the small computer market" was a common statement, as though this thriving industry somehow needed IBM's belated blessing to even exist. Many people quickly forgot that this industry was doing just fine, thank you, *years* before IBM was willing to concede that computers might be owned by individuals rather than by corporations.

Overwhelming Influence

And so, as an industry, we had to live with *fewer* colors, cumbersome peripheral cards, and expense after expense. But, we were told, don't compare the PC to the Commodore 64. The PC is *not* a home computer, it's a computer for *business*. Big, bold, expensive, time-consuming to use—after all, who ever said computing should be fun?

Nonetheless, many software artisans and hardware copyists said, "If IBM does it, it must be right."

Within a short period, IBM work-alike computers were appearing in droves, and almost every software house in the country rushed to produce software for this machine. It made great business sense, and everybody thrived.

Some of us thought that IBM's *home* entry would make up for some of the PC's shortcomings.

After all, the consumer marketplace had been bombarded with technological marvels for years: Atari had shown us that good colors can be created when you have independent control of hue *and* luminance.

The sound chip capabilities of Atari and Commodore computers took computers out of the beep and click stages and gave us harpsichords and pipe organs instead.

Waiting For Junior

One processor was no longer enough—multiprocessor computers for home use became commonplace. Apple redid the II and produced the crisp and competitively priced IIe. All was right with the home computer world as we eagerly awaited IBM's announcement.

When the long-awaited PCjr was announced, some of us thought that IBM hadn't even looked at the competitive products. Borrowing a page from the past, the PCjr used a bulky external

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power transformer. Yes, so does Commodore and Atari, but we never liked this external transformer, and IBM had a chance to improve in this area.

Looking at the PCjr overall, it reminds me of the Coleco Adam—a computer system that for under $700 provides everything you need—software, letter quality daisy wheel printer, etc. The PCjr may have borrowed from Adam's good looks, but the IBM starter system has no mass storage device, no software, no printer, and doesn't even come with a cable to connect the computer to a TV or monitor.

The Controversial Keyboard

Aside from its striking price difference from the Adam, the PCjr does have one other difference: The Adam has a decent typewriter-like keyboard while the PCjr has what we call a "Chiclet keyboard."

Old-time readers might recall that in 1980 I wrote of the TRS-80 Color Computer's keyboard: "I do find the noise from the keyboard to be a bit annoying—somewhat like typing on a plate full of pennies...." The fact is that Chiclet keyboards were poor choices when Radio Shack and TI used them. In the intervening years, Radio Shack and TI switched to full-stroke, typewriter-style keyboards.

To my knowledge, IBM entered the market as the *only* personal computer manufacturer to promote a keyboard design that had been tried and rejected by the customers of several other computer manufacturers.

Once again, almost every trade magazine includes an editorial claiming that "IBM has now made the home computer market legitimate."

Buying The Brand

What is happening to us? Why are we apparently so willing to have our technological expectations sacrificed on the altar of brand-name recognition?

Yes, it is true that companies like Apple haven't been in the computer business as long as IBM, but that doesn't mean that their service is any poorer. Somehow, even though they had no prior experience in this marketplace, IBM had cultivated an image that so excited the computer-buying public that they could have sold *anything* and people would have bought it.

To me it is tragic that, given the history of IBM, they didn't use their entry to establish new standards of excellence, user-friendliness, and sensitivity to the price expectations of the public. Had they done that, the PCjr would have been worth the wait.

Standard Disappointments

If the PCjr is one step backward, it is not alone. When I first heard about the MSX computers, I was quite pleased. For the first time since the start of this industry, several manufacturers got together to create a standard for everything from disk drives to joysticks.

From the customer's perspective, this was a dream come true. Every time I address the general public, someone asks why they can't run an Apple disk on their Atari computer.

Good question. After all, everybody knows you can play the same phonograph record or video tape on equipment from any number of manufacturers.

So, a standard was a good idea in my mind. The problem with the MSX computers is that the standard was designed around the Z-80A microprocessor. As a result, we are going to see 1970's technology locked into a standard with total disregard to the advancements in 16-bit and 32-bit architectures that are much more powerful. One always expects some tradeoff when several companies share in a joint decision (after all, it is said that a camel is a horse designed by a committee), but this technological back-step seems to be too high a price to pay.

Saved By Competition?

Will the marketplace take care of this problem by itself? After all, consumers have made their desires known in the past. Well, if SONY, Yamaha Hitachi, Mitsubishi, Pioneer, Fujitsu and the others (yes, Virginia, there is an American MSX machine—from Spectravideo) enter our market with a media blitz equal to that used to sell televisions, it will take a lot of resistance to keep from falling in line. In fact, I wouldn't be surprised to see companies like Commodore introduce an MSX computer just to preserve their market share.

But the darkest hour is always just before dawn, and there is a refreshing glimmer that shows an alternative to these two technologically backward steps.

A Bright New Apple

This refreshing one-step-forward is the Apple Macintosh—a computer designed for anyone to use. Macintosh is reasonably priced ($2500 *including* display and disk drive and operating system software—IBM, please note). But more important than Macintosh's system price is the almost intuitively simple manner in which it is used.

I maintain that any COMPUTE! reader can *master* Macintosh in 30 minutes. It is, by far, the easiest computer I have used since I worked at the Xerox Palo Alto Research Center. PARC was the spiritual home of some of the software ideas so masterfully implemented in Macintosh. This computer is designed from the ground up to be responsive to the user's way of doing things, rather than forcing the user to bend to the arbitrary constraints of the

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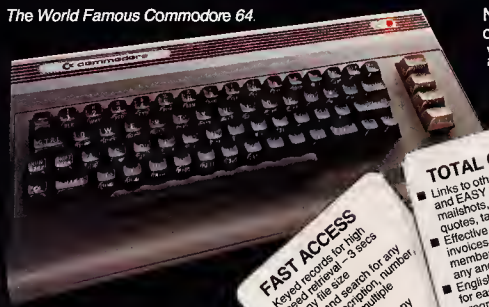

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To take just one example, suppose you want to edit a letter you have written with the *MacWrite* word processor. Once you have inserted your disk, your screen shows you a set of icons representing the various items stored on the disk, with their names beneath them. These items might be documents, pictures, programs, schedules, etc.

You use the mouse to move the cursor to the icon representing the document you want to edit, and with a couple of clicks you have automatically loaded the word processor which has automatically loaded the document for you to edit.

Truly Innovative

Macintosh is, quite simply, a civilized machine. After working with it for a while, I found myself quite intolerant of my other computers. The

Counterpoint:

Computers And Society, June 1984

David wrote his first article for me in the first issue of COMPUTE!, *Fall 1979. Since then he has been a regular columnist. One of the constants of our working relationship in all these years is that David has been free to share his thoughts—after all, who could ever justify curbing a column called "Computers and Society," especially in 1984?*

I have some problems with this particular column of David's. Among our editorial staff here I do not have unanimous support. On the other hand, I'm not alone in my concerns. Thus, David's column is presented here in full; my comments appear below.

Robert C. Lock, Editor In Chief

It would seem that the primary criticism of IBM is their "failure" to introduce personal computing products that are hallmarks of technological innovation. In any maturing industry, there are always leaders, entrepreneurs, bastion stormers who take the risks, blaze the trails, and yes, make several mistakes and fail—or make fewer and survive. I would suggest that IBM passed through that phase in its maturation as a company some decades ago. Right or wrong, such a process is also a part of the American Dream in action.

The Case Is Overstated

To characterize IBM as a sleeping giant, stumbling awake to inflict awkward products on a naive public, is unrealistic. In part, it simply reflects the changing values one frequently encounters in a maturing market. While it may be frustrating that the IBM products don't reflect a state-of-the-art technology, it can also be argued that they reflect a tested, tried, and reliable technology.

Is this a sidestep argument? I don't think so. No more than to argue that IBM computers sell simply because they're IBM computers. Built into that statement is a tradition that's also a reflection of the various levels of maturation of the marketing process. Given appropriate emphasis, the statement can be negative; given another emphasis, it can be exceptionally positive.

Consumers Trust IBM

I don't think that IBM could have sold "anything," and that people would have bought it. At least not for long. That's not what IBM's all about. Their business is to deliver reliable working products that meet a need in the market.

Have they done that? The demand for their personal computer products would seem to indicate their success. Have they failed to "establish" new standards of excellence? I would disagree. Have they had the design problems, delivery problems, service problems, continually revamped operating systems, bugs and fixes, that have bedeviled less mature companies over the years? Have we seen them "experiment" with the public by quickly, hastily bringing to market a product that's gone in six months—or worse, never delivered? Have we seen them vacillate in and out of the market with promises and visions never to be fulfilled?

I think not. And I'm not quite sure why all of these "failures" indicate a deviation from their history, or a step backwards for the industry.

Rather than saying "If IBM does it, it must be right," I would argue that "If IBM does it, it will probably be valid." After all of the arguments and questions over the last few years about the true utility of home computers, and the myriad of attempts to expand their usefulness to a broader base of the population, IBM is showing a willingness to take a certain kind of risk. It may not be in the area of sophisticated graphics, or breakthroughs in software, but I would venture to guess that the recently announced joint venture between IBM, Sears, and CBS to develop mutual utilization of home computers will have a chance at making a massive step forward in the ability of our industry to mature as a functional home "utility."

Innovation comes in many guises, not all of them hardware- or software-based.

And David, a p.s.: I agree with you on that strange little keyboard.

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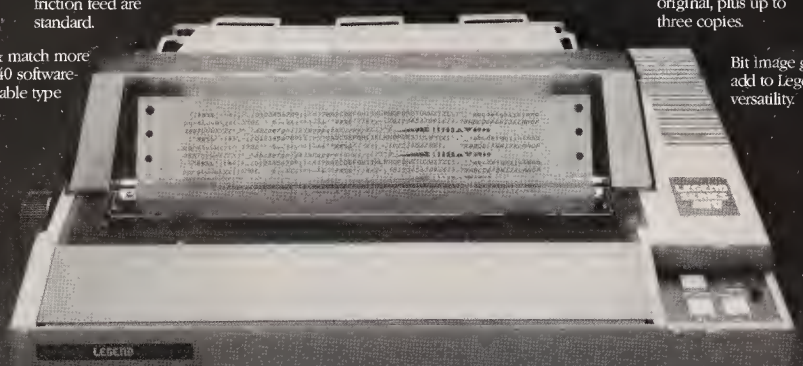

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Macintosh is qualitatively distinct from any other personal computer. It has defined a new tier of the market.

This definition had happened *not* because of its 32-bit architecture, its 1 to 2 million instructions-per-second speed, or its price, but simply because of its functionality. For years the industry has been telling us that computers are easy to use. Macintosh finally came out to fulfill that promise.

But will Macintosh be successful? I hope so. Apple appears dedicated to supporting third-party software developers, and several powerful languages are available for users who like to create their own programs.

Back On The Right Track

There is another reason I hope Macintosh is successful. This country was built on the concept that people with good ideas could compete in the open marketplace. This spirit of open competition guaranteed not only that the customer got a good deal, but that technology would improve as newer and better products were developed. If, by pure force of corporate identity, we can be convinced to drop our high standards of cost-effective performance, we can kiss the free enterprise system goodbye.

Macintosh is more than a computer—it is a statement in response to the clearly stated needs of the consumer. How will *we* respond? ©

INSIGHT: Atari

Bill Wilkinson

As I write this, I have just returned from the Las Vegas Comdex show.

Comdex stands for "COMputer Dealers' EXposition," but it is really a show for those who would sell *to* the computer dealers. And sell they did. Everything from magic acts to talking robots to sit-down demonstrations (very welcome after walking through literally acres and acres of booths). And, of course, IBM was there in force, occupying an entire building and demonstrating the usual stuff on the PC and, not surprisingly, some me-too-ish software on the PCjr.

Compatible Disk Drives

The only Atari-compatible hardware products that I saw at Comdex were some disk drives (though I understand that one or two graphics tablets were shown there, also). And that, of course, brings up my next topic.

When you consider the fact that Atari doesn't even make a double-density disk drive, it's more than a little surprising and pleasing to discover the amazing degree of compatibility exhibited by the various non-Atari disk drives.

Since OSS provides the disk operating system (DOS XL) which many of the drive manufacturers supply with (or as an option to) their disks, I can't make judgments as to quality, reliability, etc., without an obvious conflict of interest. I can, however, comment on the features common to all Atari-compatible drives (except those made by Atari itself).

The 815 Drive's Legacy

Historically, the reason for the compatibility is the ill-fated Atari 815 drive. For those of you relatively new to the world of Atari, that was the dual, double-density disk drive announced by Atari for delivery in early 1982. Notice the word "was."

Although never produced in quantity, the 815 survived long enough to cause Atari, Inc., to produce DOS 2.0d ("d" for double), and a few lucky people even have a copy of it. (I'm not lucky.) In fact, even Atari DOS 2.0s can access an 815 style double-density drive for most functions (just don't try to copy files or duplicate disks).

The folks at Percom Data Corporation, though, didn't know the 815 was going to die when they started designing their double-density drives. They did, however, want a way to switch from single to double density without having to physically flick a switch. Hence the configuration block was born. Give Percom credit.

Give the other manufacturers credit, also, for recognizing the Percom system as a viable and usable standard. Would you be surprised to find that the same double-density DOS XL diskette works unchanged in drives or controllers from (in alphabetical order) Amdek, Astra, Concorde, Indus, Micro Mainframe, NCT, Percom, Rana, SPI, and Trak? If you are *not* surprised, you are not aware of the hodgepodge of the CP/M world.

Each of the companies mentioned can tell you of the advantages of their drives or controllers.

A final comment on the configuration block

scheme mentioned above. A controller capable of implementing all the options of the configuration block can, in theory, support virtually any size disk drive. At Comdex I saw floppy disk drives with densities over a megabyte. Yum.

XL Compatibility

I have received more than a little correspondence from readers asking what they can do about the lack of software compatible with their 1200XL (and, now, the 600XL and 800XL). Up until now, my stock answer has been that they should go beat on the heads of the software manufacturers (the ones who didn't follow Atari's rules).

Now, though, there is a little relief in sight. Atari has, at long last, made available something known as the Atari Translator Disk. This disk, when booted from any 810-compatible drive into any XL machine with 64K of RAM, will (for all practical purposes) turn your XL computer into a non-XL Atari 800. Virtually all software, including protected games and the like, will then boot and run properly. (Of course, you don't turn the power off to boot anymore.)

For those who are stuck with incompatible software, this seems like a neat solution. For those who are stuck with incompatible software and no disk drive, this looks like a frustrating solution. Point of interest: I do believe that this software could be loaded via cartridge instead, since one need not turn off the power to change or remove cartridges on an XL machine. Atari, are you listening?

Anyway, if you need the disk, check with your local authorized Atari dealer. If he doesn't have it, hasn't heard of it, or is nonexistent, try Atari's customer service department.

Reading Binary Files

In March, I presented a short program in Atari BASIC which would read a binary object file directly into the memory locations it was originally assembled for (or saved from).

This month, I will start to parallel that listing in machine language. Please understand that this may not be the fastest or easiest way to perform the task. I use the BASIC parallel method as a way of making the program understandable to those who are just beginning to learn machine language.

As a first step, you might look through the listing, noting where the BASIC line equivalents are. They are easy to find. Starting at line 1000, any line number ending in 00 is a comment line which reflects the line in the BASIC program which I presented last month. Note, also, that the line numbers in this listing are 10 times the BASIC line numbers (simply for convenience and readability).

While examining the listing, you probably noted that there seems to be more nonparallel code than otherwise. In truth, this simple pseudo-BASIC program does indeed require a fairly substantial amount of support. The support is in two forms: definitions of variables (including buffers) and I/O subroutines.

A Page 6 Assembly

You may also have noticed that I assembled the listing in the infamous page 6 memory block. I plead guilty. Actually, in testing this program, I assembled it twice: once at $600, as shown, and once at $6000 (just by changing line 110). I then used the $600 version to read in the $6000 version, and it worked!

Anyway, since I will be giving you complete source code here, I don't feel too guilty. Obviously, you can change line 110 to anything you wish if you need to stay out of page 6.

There are two other "cheats" in this listing. In line 220, I place NAME at location $580; and, in lines 250 and 270, I place START and ADDR at location $CE. Are these locations truly safe to use? In general, no. If you have been reading my series on self-relocatable code, you know that there are no truly safe locations. But for the purposes of this demonstration, I think we can use them as is, since they are compatible with usage by the Atari Assembler Editor (and MAC/65 and—I believe—AMAC) and Atari BASIC (and BASIC XL but not Microsoft BASIC).

One other comment before we begin analyzing the operation of the listed code. If you wish to use this program as a callable USR routine from Atari BASIC, you need to add this line:

```
125 PLA; clean up stack for BASIC
```

BASIC And ML Compared

Now, onward and downward, into the depths of machine language. I will discuss the lines which I feel are relevant and important by line number.

Line 130. We could have accomplished the same thing by giving a RUN address at the end of the listing, but this gets us started in a visible way.

Line 210. Note the use of the $9B (an ATASCII RETURN code) to terminate the message. The 0 is for safety and because I am paranoid.

Double Usage

Lines 230, 240, 260. If you consider LOW and HIGH together, they form a 16-bit word. Since QUIT needs to be a word, why not join usage? This is not recommended procedure, but it works if you are careful.

Lines 250, 270. This isn't surprising if you think about the fact that line 310 in the BASIC code could have been written as FOR START= START TO QUIT, thus eliminating the need for the extra variable, ADDR.

Lines 300–321. These are the same equates you have seen many places, including in the Atari

OS listings and *Inside Atari DOS* though the actual mnemonics may differ slightly.

Lines 550–566. When you get to this routine, it expects the OS channel designator (which is 16 times the Atari BASIC file number) in the X register, the command value in the A register, and the address of the buffer to use in the Y register (low byte) and on the stack (high byte). The routine assumes that you will not be doing I/O which requires over 255 bytes of buffer (a valid assumption for this program, but not for all circumstances).

Checking For Errors

CMDJOIN sets up the appropriate IOCB and calls CIO to do the real work. It returns the error status to the user in A, Y, and the flags. In this program, only OPEN looks for the error status. (Because PRINT and INPUT to/from channel zero had *better* work, and if CLOSE fails it's too late anyhow.)

Lines 500–545. These are the various I/O entry points. Note that they expect the X and Y registers set up as in CMDJOIN. They assume that the high byte of the buffer address is in A and push it on the stack to make room for the command byte. They are simple and effective.

Next month we'll look at the rest of this listing.

Load A Binary Object File

```
                    0100      .TITLE "Binary Object File Loader for COMPUTE!"
                    0101 ;
                    0102 ;
                    0103 ; a binary object file loader in assembly language
                    0104 ;
0000                0110      *=  $0600    ; an arbitrary location
0600                0120 BEGIN
0600 4C6006         0130      JMP BEGINWORK ; skip data and subroutines
                    0140 ;
                    0150 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                    0160 ;
                    0170 ; variables and buffers
                    0180 ;
                    0190 ; defined in order encountered in BASIC program
                    0200 ;
0603 57484154       0210 MESSAGE .BYTE "WHAT FILE TO LOAD ?",$9B,0
0607 2046494C
060B 4520544F
060F 204C4F41
0613 44203F9B
0617 00
     =0580          0220 NAME =  $0580    ; buffer for file name (see text)
0618 00             0230 LOW .BYTE 0      ; low byte of address
0619 00             0240 HIGH .BYTE 0     ; high byte of address
     =00CE          0250 START = $CE      ; although START could be anywhere,
                    0251 ;                  ADDR (see below) needs zero page
     =0618          0260 QUIT =  LOW      ; accomplishes line 270 of BASIC program
     =00CE          0270 ADDR =  START    ; accomplishes part of FOR statement
                    0271 ;                  in line 310 (see text)
                    0300 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                    0301 ;
                    0302 ; system equates, etc.
                    0303 ;
     =0340          0304 IOCB =  $0340    ; where IOCB #0 is
     =0342          0305 ICCOM = $0342    ; the command byte
     =0344          0306 ICBADR = $0344   ; buffer addr
     =0348          0307 ICBLEN = $0348   ; buffer length
     =034A          0308 ICAUX1 = $034A   ; aux 1 byte (open mode)
                    0310 ;
     =0003          0311 CMDOPEN = 3      ; the open command
     =000C          0312 CMDCLOSE = 12    ; the close command
     =0009          0313 CMDPRINT = 9     ; put a text line
     =0005          0314 CMDINPUT = 5     ; get a text line
     =0007          0315 CMDGET = 7       ; get a binary byte or block
                    0320 ;
     =E456          0321 CIO =   $E456    ; the master I/O routine for Atari OS
                    0498      .PAGE ".        Major I/O Subroutines"
                    0499 ;
                    0500 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
```

```
                    0501 ;
                    0502 ; the subroutines used by our program
                    0503 ;
                    0510 ; --- perform an OPEN function ---
061A                0511 OPEN
061A 48             0512     PHA          ; save high byte of address
061B A903           0513     LDA #CMDOPEN
061D D00D           0514     BNE CMDJOIN
                    0515 ;
                    0520 ; --- perform a CLOSE function ---
061F                0521 CLOSE
061F 48             0522     PHA          ; save high byte of address
0620 A90C           0523     LDA #CMDCLOSE
0622 D008           0524     BNE CMDJOIN
                    0525 ;
                    0530 ; --- perform a PRINT function ---
0624                0531 PRINT
0624 48             0532     PHA          ; save high byte of address
0625 A909           0533     LDA #CMDPRINT
0627 D003           0534     BNE CMDJOIN
                    0535 ;
                    0540 ; --- perform an INPUT function ---
0629                0541 INPUT
0629 48             0542     PHA          ; save high byte of address
062A A905           0543     LDA #CMDINPUT
                    0545 ;
                    0550 ; code common to OPEN, CLOSE, PRINT, INPUT
                    0551 ;
062C                0552 CMDJOIN
062C 9D4203         0553     STA ICCOM,X ; the command value
062F 68             0554     PLA          ; recover high byte of addr
0630 9D4503         0555     STA ICBADR+1,X ; and set it up in iocb
0633 98             0556     TYA
0634 9D4403         0557     STA ICBADR,X ; ditto with low byte of addr
0637 A900           0558     LDA #0
0639 9D4903         0559     STA ICBLEN+1,X ; set up a maximum length
063C A9FF           0560     LDA #255
063E 9D4803         0561     STA ICBLEN,X ; of 255 bytes
0641 2056E4         0562     JSR CIO      ; then do the I/O operation
0644 98             0563     TYA          ; any boo-boo's ?
0645 60             0564     RTS          ; back to caller with error, if any
                    0565 ; (note that only OPEN call provides for
                    0566 ;  an error...see text)
                    0598     .PAGE ".        The GET Subroutine"
                    0599 ;
                    0600 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                    0601 ; the GET routine...it's special
                    0602 ;
0646                0603 GET
0646 A907           0604     LDA #CMDGET
0648 9D4203         0605     STA ICCOM,X ; set up for GET command
064B A900           0606     LDA #0
064D 9D4803         0607     STA ICBLEN,X ; by zeroing the length field,
0650 9D4903         0608     STA ICBLEN+1,X ; ...we get a single byte to A
0653 2056E4         0609     JSR CIO      ; let OS do the work
0656 C8             0610     INY
0657 88             0611     DEY          ; check status "invisibly"
0658 3001           0612     BMI BADGET   ; oops
065A 60             0613     RTS          ; back to caller
                    0614 ; (remove BMI for caller to get status instead)
                    0615 ;
065B                0616 BADGET
065B 68             0617     PLA
065C 68             0618     PLA          ; this is a cheat
065D 4CE706         0619     JMP LINE400 ; but it works
                    0989     .PAGE ".        BASIC parallel code, lines 100-240" ©
```

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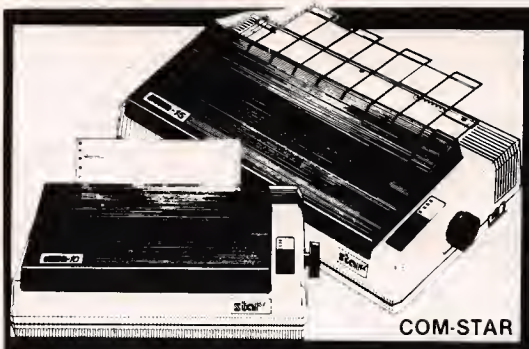

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64 EXPLORER

Larry Isaacs

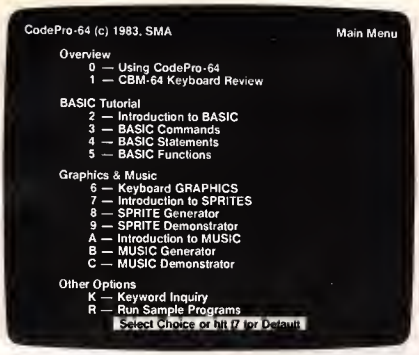
This month we'll take a look at part of a disassembly of the machine language drawing routines which were presented last month. For those who are learning 6502 machine language programming, there are a few items you may find interesting in the source listing for these routines. First of all, if you are new to interfacing machine language routines to BASIC, you can refer to the GETINT subroutine. This subroutine will evaluate an integer expression and return the resulting value. Typically, a machine language routine will need only integer arguments, assuming it needs arguments at all. One potential problem with using a routine like GETINT is that the integer is signed. Integer values greater than 32767 would have to be entered as ‹value› –65536 before they could be fetched by this routine.

Another thing you might note is how a multiplication by 320 was accomplished in the PIXADR subroutine. The code is based on the fact that multiplication and division by powers of two can be done with left and right shifts of the binary number in question. By converting the expression (320*Y) to (256*Y+64*Y), the multiplication can be carried out by simple shifting. Multiplying by 256 is done by taking the one-byte Y value and storing it as the high byte of a two-byte number. The low byte would be set to zero. The term 64*Y was obtained by dividing the 256*Y term by 4 (that is, two right shifts). Adding the two terms together gives 320*Y.

I hope the comments in the source code provide enough information to understand what the program is doing. If you have an assembler at your disposal, you are certainly welcome to use any of the routines here for your own experiments.

Machine Language Drawing Routines

```
;
; MACHINE LANGUAGE DRAWING ROUTINES
;
; EQUATES
;
TIMACT   = $DC0E ;TIMER A CONTROL
MEMCTL   = $DD00 ;C64 MEMORY CONTROL
VICCTL   = $D011 ;VIC CONTROL REGISTER
VICCT2   = $D016 ;VIC CONTROL REGISTER
VICMCT   = $D018 ;VIC MEMORY CONTROL
BCREG    = $D021 ;BACKGROUND COLOR REG.
BMBASE   = $E000 ;BIT-MAP BASE
BMOFFS   = $08   ;8K OFFSET BYTE
SMBASE   = $C800 ;SCREEN MEMORY BASE
CMBASE   = $D800 ;COLOR MEMORY BASE
SMOFFS   = $20   ;SCREEN MEMORY OFFSET
BMMODE   = $20   ;BIT-MAP ENABLE BIT
MCMODE   = $10   ;MULTICOLOR MODE
;
; COMMODORE ROUTINES
;
ADRAY2   = $0005 ;INT TO FLOAT (VECTOR)
FTOINT   = $B1AA ;FLOAT TO INT
COMMA    = $AEFD ;CHECKS FOR COMMA
EVAL     = $AD9E ;EVALUATE ARGUMENT
;
; PAGE ZERO EQUATES
;
ROMCTL   = $1  ;ROM CONTROL REGISTER
VALTYP   = $0D ;TYPE OF ARGUMENT
TMP      = $61 ;TEMP BYTE
TMP1     = $FB ;TEMP 1
TMP2     = $FD ;TEMP 2
DX       = $62 ;DELTA X
DY       = $64 ;DELTA Y
R        = $66 ;REMAINDER VARIABLE
XINC     = $6A ;X INCREMENT
YINC     = $6C ;Y INCREMENT
CNT      = $68 ;COUNTER
;
; JUMP TABLE
;
         *= $C000
         JMP SVSCRN ;SAVE SCREEN PARMS
         JMP RSSCRN ;RESTORE PARMS
         JMP GRSCRN ;ENABLE GRAPHICS
         JMP CLRSCR ;CLEAR GR. SCREEN
         JMP MOVE   ;MOVE TO X,Y
         JMP PLOT   ;PLOT X,Y
         JMP DRAW   ;DRAW TO X,Y
         JMP SETDRM ;SET DRAWING MODE
         JMP SELCOL ;SELECT COLOR
         JMP RDBYTE ;READ BYTE FUNCTION
;
; LOCAL STORAGE
;
XC       .WORD 0 ;CURRENT X-COORD
YC       .WORD 0 ;CURRENT Y-COORD
XN       .WORD 0 ;NEW X-COORD
YN       .WORD 0 ;NEW Y-COORD
COLOR    .BYTE $FF ;DRAWING COLOR DUPL.
                   ;IN EACH PIXEL POS.
DRMODE   .BYTE $80 ;DRAWING MODE
                   ;$00 & $40 = ERASE
                   ;$80=DRAW, $C0=FLIP
MCFLAG   .BYTE 0   ;MULTICOLOR FLAG
MASK1    .BYTE $07 ;BIT MASK
MASK2    .BYTE $F8 ;BIT MASK INVERTED
;
S1       .BYTE 0 ;SAVE MEMCTL
S2       .BYTE 0 ;SAVE VICMCT
S3       .BYTE 0 ;SAVE VICCTL
S4       .BYTE 0 ;SAVE VICCT2
;
; CMD SUB: SAVE SCREEN PARMS
;
SVSCRN   LDA MEMCTL
         STA S1
         LDA VICMCT
         STA S2
         LDA VICCTL
```



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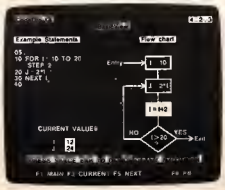

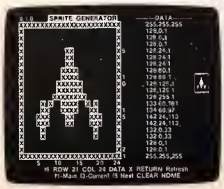

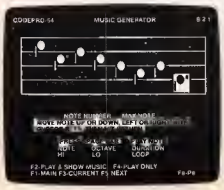

SMA SYSTEMS MANAGEMENT ASSOCIATES

```
        STA S3
        LDA VICCT2
        STA S4
        RTS
;
; CMD SUB: RESTORE SAVED SCREEN PARMS
;
RSSCRN  LDA S1
        STA MEMCTL
        LDA S2
        STA VICMCT
        LDA S3
        STA VICCTL
        LDA S4
        STA VICCT2
        RTS
;
; SUB: TURN OS ROM OFF
;
OSOFF   PHA
        LDA TIMACT ;TURN OFF IRQ'S
        AND #$FE
        STA TIMACT
        LDA ROMCTL ;TURN OFF OS ROM
        AND #$FD
        STA ROMCTL
        PLA
        RTS
;
; SUB: TURN BASIC ROM ON
;
OSON    PHA
        LDA ROMCTL ;TURN ON OS ROM
        ORA #$02
        STA ROMCTL
        LDA TIMACT ;ENABLE IRQ'S
        ORA #$01
        STA TIMACT
        PLA
        RTS
;
; SUB: FILL AN AREA OF MEMORY
;
; ON ENTRY: A= FILL BYTE
; TMP1 = POINTER TO AREA
; TMP2 = # BYTES TO FILL
;
; ON RETURN: A AND X PRESERVED.
; Y, TMP1, AND TMP2 CLOBBERED.
;
FILL    LDY TMP2+1 ;FILL WHOLE PAGES
        BEQ FILL3  ;BR IF NONE
FILL1   LDY #0
FILL2   STA (TMP1),Y
        INY
        BNE FILL2
        INC TMP1+1 ;INCREMENT POINTER
        DEC TMP2+1 ;DECREMENT # PAGES
        BNE FILL1  ;BR IF MORE PAGES
FILL3   LDY TMP2   ;CHECK PARTIAL PAGE
        BEQ FILL6  ;BR IF DONE
        DEY        ;CLEAR PARTIAL PAGE
        BEQ FILL5  ;GO CLEAR LAST BYTE
FILL4   STA (TMP1),Y
        DEY
        BNE FILL4
FILL5   STA (TMP1),Y ;THE LAST BYTE
FILL6   RTS
;
; SUB: FILL BIT-MAP AND SCREEN MEM
;
; ON ENTRY: A=SCREEN MEMORY COLORS
; X=COLOR MEMORY COLOR IF MULTICOLOR
;
; ON RETURN: ALL REGISTERS CLOBBERED
;
FILLSC  JSR OSOFF    ;TURN OS ROM OFF
        LDY #<SMBASE ;FILL SCREEN MEM
        STY TMP1
        LDY #>SMBASE
        STY TMP1+1
        LDY #<1000 ;1000 BYTES
        STY TMP2
        LDY #>1000
        STY TMP2+1
        JSR FILL
        BIT MCFLAG ;MULTICOLOR MODE?
        BPL FILLS1 ;BR IF NO
        LDY #<CMBASE ;FILL COLOR MEM
        STY TMP1
        LDY #>CMBASE
        STY TMP1+1
        LDY #<1000
        STY TMP2
        LDY #>1000
        STY TMP2+1
        TXA
        JSR FILL
FILLS1  LDA #<BMBASE ;CLEAR BIT-MAP
        STA TMP1
        LDA #>BMBASE
        STA TMP1+1
        LDA #<8000 ;8000 BYTES
        STA TMP2
        LDA #>8000
        STA TMP2+1
        LDA #0
        JSR FILL   ;CLEAR
        JMP OSON   ;TURN OS ROM ON
                   ;AND RETURN
;
; SUB: GET AN INTEGER ARGUMENT
;
; ON ENTRY: NO REGISTER ARGUMENTS
;
; ON RETURN: X,A = INTEGER, A=LOW BYTE
;
GETINT  JSR COMMA  ;MAKE SURE COMMA
        JSR EVAL   ;GET ARGUMENT
        JSR FTOINT ;CONVERT TO INTEGER
        TAX
        TYA
        RTS
;
; SUB: GET X AND Y COORDINATES
;
; ON ENTRY: NO REGISTER ARGUMENTS
;
; ON RETURN: ALL REGISTERS CLOBBERED
; XN,YN = COORDINATES
;
GETXY   JSR GETINT ;GET X
        STA XN
        STX XN+1
        JSR GETINT ;GET Y
        STA YN
        STX YN+1
        RTS
;
; CMD SUB: ENABLE GRAPHICS SCREEN
;
; SYNTAX:  SYS GRSCRN,MC
; MC: 0=HIRES, 1=MULTICOLOR
;
```

```
GRSCRN  JSR GETINT ;GET MODE
        BEQ GRSCR1 ;BR IF LOW BYTE=0
        LDA #$80
GRSCR1   STA MCFLAG ;SET FLAG
        LDA MEMCTL ;SET GRAPHICS BANK
        ORA #$03
        EOR #BMBASE/$4000
        STA MEMCTL
        LDA VICMCT ;SET OFFSETS
        AND #$07   ;CLEAR OLD BITS
        ORA #BMOFFS ;SET BIT-MAP OFFSET
        ORA #SMOFFS ;SET SCREEN OFFSET
        STA VICMCT
        LDA VICCTL ;ENABLE BIT-MAP
        ORA #BMMODE
        STA VICCTL
        BIT MCFLAG
        BPL GRSCR2 ;BR IF HIRES
        LDA VICCT2 ;SELECT MULTICOLOR
        ORA #MCMODE
        STA VICCT2
        LDA #$03   ;SET MASKS
        BNE GRSCR3 ;BR ALWAYS
;
GRSCR2   LDA VICCT2 ;DISABLE MULTICOLOR
        AND #$FF-MCMODE
        STA VICCT2
        LDA #$07   ;SET MASKS
GRSCR3   STA MASK1
        EOR #$FF
        STA MASK2
        LDA #$FF
        STA COLOR ;INIT COLOR
        RTS
;
; CMD SUB: CLEAR GRAPHICS SCREEN
;
; SYNTAX: SYS CLRSCR,C0,C1    (HIRES)
;  SYS CLRSCR,C0,C1,C2,C3 (MULTICOLOR)
;
CLRSCR   JSR GETXY ;GET TWO COLORS
        BIT MCFLAG
        BMI CLRSC1 ;BR IF MULTICOLOR
        LDA YN     ;GET "ON" COLOR
        ASL A     ;SHIFT TO UPPER NIBBLE
        ASL A
        ASL A
        ASL A
        STA YN
        LDA XN     ;GET "OFF" COLOR
        AND #$0F
        ORA YN     ;COMBINE THE TWO
        JMP FILLSC ;GO FILL SCREEN
CLRSC1   LDA YN     ;GET COLOR 1
        ASL A     ;SHIFT TO UPPER NIBBLE
        ASL A
        ASL A
        ASL A
        STA YN
        JSR GETINT ;GET COLOR 2
        AND #$0F
        ORA YN     ;GET SCR MEM COLORS
        STA YN
        JSR GETINT ;GET COLOR 3
        TAX        ;MOVE TO X
        LDA XN
        STA BCREG  ;SET BACKGRND COLOR
        LDA YN
        JMP FILLSC ;GO FILL SCREEN
;
; CMD SUB: MOVE TO X,Y
;
; SYNTAX: SYS MOVE,X,Y
;
MOVE    JSR GETXY
MOVEA    LDX #3    ;ALTERMATE ENTRY POINT
MOVE1    LDA XN,X
        STA XC,X
        DEX
        BPL MOVE1
        RTS
;
; SUBROUTINE CALCULATE PIXEL ADDRESS
;
; ON ENTRY: NO REGISTER ARGUMENTS
; XC,YC = X,Y COORDINATES
; FOR HIRES MODE
;   MASK1=$07,MASK2=$F8,MCFLAG=0
; FOR MULTICOLOR MODE
;   MASK1=$03,MASK2=$FC,MCFLAG=$80
;
; ON RETURN: A AND Y CLOBBERED
; X = INDEX TO PIXEL IN BYTE
; TMP1 = POINTER TO BYTE
;
PIXADR  SEC
        LDA #199   ;GET 199 - Y COORD
        SBC YC
        PHA        ;SAVE Y COORD
        LSR A      ;CALCULATE ROW=Y/8
        LSR A
        LSR A
        STA TMP1+1 ;STORE ROW*256
        LDY #0
        STY TMP1   ;INIT LOW BYTE
        LSR A      ;GET ROW*64=
        ROR TMP1   ;    (ROW*256)/4
        LSR A
        ROR TMP1
        ADC TMP1+1 ;ADD ROW*256+ROW*64
        STA TMP1+1 ;THIS IS ROW*320
        LDA XC
        LDX XC+1
        AND MASK2  ;GET INT(X/BPP)*8
        BIT MCFLAG ;TEST FOR MC MODE
        BPL PIXAD1 ;BR IF HIRES BIT MAP
        ASL A      ;* 2 IF MC BIT MAP
        PHA
        TXA
        ROL A
        TAX
        PLA
PIXAD1   CLC
        ADC TMP1   ;ADD TO ADDRESS
        STA TMP1
        TXA
        ADC TMP1+1
        STA TMP1+1
PIXAD2   PLA        ;GET BACK Y COORD
        AND #$07   ;GET Y AND $07
        CLC
        ADC TMP1   ;ADD TO ADDRESS
        BCC PIXAD3 ;BR IF NO CARRY
        INC TMP1+1 ;BUMP HIGH BYTE
PIXAD3   CLC
        ADC #<BMBASE ;ADD BASE ADDRESS
        STA TMP1
        LDA TMP1+1
        ADC #>BMBASE
        STA TMP1+1
        LDA XC     ;GET INDEX TO BIT
        AND MASK1
        TAX
        RTS
```

©

MACHINE LANGUAGE

Jim Butterfield, Associate Editor

A Program Critique — Part 3

This month we continue with comments on Bud Rasmussen's program to copy files on the Commodore 64 with a single disk unit. The program has so far read into RAM memory a file specified by the user.

In this session, we'll track the routine that writes the file to a new disk.

```
                    ;
                    ;
                    ; START OUTPUT PHASE
                    ;
                    ;
C2F7  20  E4  FF  SOP   JSR  GETIN     ;GET CHARACTER
C2FA  F0  FB            BEQ  SOP       ;IF NONE, TRY
                                        AGAIN
C2FC  C9  0O            CMP #RK        ;IS THIS
C2FE  F0  01            BEQ  POPM      ;RETURN KEY
C300  00                BRK            ;IF NOT, BRK
                    ;
```

Wait for the RETURN key. If any other key is received, the program will break to the machine language monitor (if there is one). This has a possible problem: Keyboard bounce could cause a halt here. I'd prefer something like this:

```
                    JSR  GETIN     ;clear input
               LOOP JSR  GETIN     ;get character
                    CMP #RK        ;if not RETURN...
                    BNE  LOOP      ;go back and wait
```

As mentioned before, a BRK (Break) is to be avoided since users won't understand what it means.

Output Phase Begun

Next, we arrange to print an advice message:

```
C301  A2  23      POPM LOX  #OPBML ;PRINT
C303  A0  C3           LOY  #>OPBM ;'OUTPUT
C305  A9  18           LOA  #<OPBM ;PHASE BEGUN'
C307  20  75  C1       JSR  PR     ;MSG
                    ;
C30A  A9  00           LOA  #0     ;CLEAR
C30C  8D  62  03       STA  OSF    ;OUTPUT STATUS
                                    FLAG,
C30F  8O  63  03       STA  OEC    ;OUTPUT ERROR
                                    COOE
                    ;
```

Again, clearing these flags may be overkill. They will take care of themselves.

```
C312  20  3F  C4       JSR  ID     ;INIT DISK
C315  4C  3B  C3       JMP  SNO    ;GOTO SET NAME
                                    OUTPUT
                    ;
```

The new disk is initialized. A wise precaution, in case the new disk happens to have the same ID as the old one.

```
                    ;
                    ; OUTPUT PHASE BEGUN MESSAGE
                    ;
                    ;
C318  0O  0O  12  OPBM  .BYTE$0O,$0O,$12
C31B  2A  2A  2A        .ASC "*** OUTPUT PHASE
                        BEGUN ***"
C339  0O  0D            .BYTE$0O,$0O
C33B              OPBML  =  *-OPBM
                    ;
```

Now we will go through the same routine which was used for input. The main difference is that this time, the name of the file is four characters longer, since ",S,W" is added to make this a write file.

```
                    ;
                    ; SET NAME ( OUTPUT )
                    ;
                    ;
C33B  AO  AB  02  SNO   LOA  OFNL    ;OUTP FILE NM LEN
C33E  A2  40            LOX  #<FNA   ;LOAO FILE NAME LO
C340  A0  03            LDY  #>FNA   ;LOAO FILE NAME HI
C342  20  BO  FF        JSR  SETNAM
                    ;
                    ; SET LOGICAL FILE ( OUTPUT )
                    ;
                    ;
C345  A9  03      SLFO  LOA  #3      ;LOGICAL FILE
                                      NUMBER
C347  A2  08            LDX  #8      ;LOAO OEVICE
                                      AOORESS
C349  A0  03            LOY  #3      ;LOAO SEC.
                                      AOORESS
C34B  20  BA  FF        JSR  SETLFS
                    ;
                    ;
                    ; OPEN FILE ( OUTPUT )
                    ;
                    ;
C34E  20  C0  FF  OFO   JSR  OPEN    ;OPEN FILE
C351  A5  90            LOA  IOS     ;TEST
C353  F0  0B            BEQ  OCO     ;STATUS
C355  8O  62  03        STA  OSF     ;STORE STATUS
C358  A9  01            LOA  #1      ;SET/STORE
C35A  8O  63  03        STA  OEC     ;ERROR COOE
C35O  4C  C5  C3        JMP  OE      ;OUTPUT ERROR
                    ;
```

Check The Disk Status

As previously noted, checking location $90, IOS—the BASIC ST variable—isn't enough to insure that the file is properly opened. You must call in the disk status over the command channel. There could be many problems in opening a file for writing: A file of that name may already exist, the disk may have the write-protect tab in place, the disk may be unformatted, or the disk might be full, to name just a few. Location $90 won't tell you about such things.

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```
                ;
                ;  OPEN CHANNEL (OUTPUT)
                ;
                ;
C360  A2 03     OCO  LDX #3        ;OPEN
C362  20 C9 FF       JSR CHKOUT ;CHANNEL 3
C365  A5 90          LDA IOS      ;TEST
C367  F0 0B          BEQ SOB      ;STATUS
C369  8D 62 03       STA OSF      ;STORE STATUS
C36C  A9 02          LDA #2       ;SET/STORE
C36E  8D 63 03       STA OEC      ;ERROR CDDE
C371  4C C5 C3       JMP OE       ;OUTPUT ERROR
                ;
```

As during the reading phase, I'd rather the comments said, "connect channel" rather than "open channel." The word "open" has special significance for a file; we have already performed the open activity with our call to OPEN ($FFC0).

```
                ;
                ;  SET OUTPUT BUFFER
                ;
                ;
C374  A0 00     SDB  LDY #0        ;BUFFER INDEX=0
C376  A9 00          LDA #0       ;LOAD BFR
C378  85 FB          STA BAL      ;ADDR LD
C37A  AD 3D C4       LDA SP       ;LOAD BFR
C37D  85 FC          STA BAH      ;AOOR HI
                ;
```

It May Miss The Address

You may recall that the input section of the program might under some circumstances change the memory start address, moving it down by 4K. If so, this part of the program would miss the changed address completely. Oops.

```
                ;
                ;  OUTPUT LOOP
                ;
                ;
C37F  B1 FB     OL   LDA (BAL),Y  ;GET CHAR
C381  20 O2 FF       JSR CHRDUT ;PUT CHAR
```

Output has been switched to logical channel 3; instead of printing to the screen, JSR $FFD2 sends to the file.

```
C384  A5 90          LDA IDS      ;TEST
C386  F0 0B          BEQ IBA      ;STATUS
C388  8D 62 03       STA DSF      ;STDRE STATUS
C38B  A9 03          LDA #3       ;SET/STDRE
C38D  8D 63 03       STA OEC      ;ERROR CODE
C390  4C C5 C3       JMP DE       ;OUTPUT ERRDR
                ;
                ;
                ;  INCR BUFFER AOOR
                ;
C393            IBA  =    *
C393  E6 FB          INC  BAL     ;INCR BFR ADDR LO
C395  D0 02          BNE  CEA     ;IF NOT 0, CHK END
                                    AD
C397  E6 FC          INC  BAH     ;INCR BFR ADDR HI
                ;
                ;  CDMPARE END ADDRESS
                ;
C399  A5 FC     CEA  LDA BAH      ;LOAD BFR ADDR HI
C39B  C5 FE          CMP EAH      ;BAH VS END ADDR
                                    HI
C39O  90 E0          BCC OL       ;IF LO, CARRY ON
C39F  A5 FB          LDA BAL      ;LOAD BFR ADDR LD
C3A1  C5 FD          CMP EAL      ;BAL VS END ADDR
                                    LD
C3A3  90 DA          BCC DL       ;IF LD, CARRY DN
                ;
```

After a comparison, BCC may be taken to mean "Branch if less." Thus, we'll branch back to OL, the output loop, if the high byte of the write address is less than that of the end address, or failing that, if the low byte is less. In this case, BNE (Branch not Equal) would do the job equally well.

Disconnecting The Channel

Next, the program closes the file since all bytes have been written. But there's an omission: Before closing the file, we should disconnect the output channel from it with JSR $FFCC. I wonder if this was overlooked because of the confusing use of the term *open*, earlier?

At this point, before closing the file, I would recommend looking at the command channel for any possible disk error message that might have been created during the write. The disk could become full as we write the program, for example.

```
                ;
                ;  END OF OISK I/O
                ;
                ;
C3A5  A9 03          LDA #3       ;SET CH 3
C3A7  20 C3 FF       JSR CLDSE    ;FOR CLOSE
                ;
C3AA  A9 0F          LDA #15      ;SET CH 15
C3AC  20 C3 FF       JSR CLOSE    ;FOR CLOSE
```

Good sequence. Always close the command channel last of all, since closing the command channel automatically causes all outstanding disk files to be closed.

```
C3AF  20 E7 FF       JSR CLALL    ;CLOSE ALL FILES
                ;
```

Not needed, if the output is properly disconnected with JSR $FFCC before closing logical file 3.

```
C3B2  A2 71          LDX #FCML    ;PRINT
C3B4  A0 C3          LDY #>FCM    ;'FILE
C3B6  A9 CC          LDA #<FCM    ;COPIEO'
C3B8  20 75 C1       JSR PR       ;MSG
                ;
```

As the program usually does, a message is neatly printed, telling the user what's going on.

```
C3BB  20 E4 FF FG    JSR GETIN    ;GET CHARACTER
C3BE  F0 FB          BEQ FG       ;IF NONE, TRY
                                    AGAIN
C3C0  C9 0D          CMP #RK      ;IS THIS
C3C2  F0 05          BEQ TA       ;RETURN KEY
C3C4  00             BRK          ;IF NOT, BRK
                ;
```

Use RTS Instead Of BRK

See the previous comment on waiting for a key to be pressed. When the program is finished, it should terminate with a BRK (Break) command only if it was invoked from the machine language monitor with a .G (Go) command. Otherwise, an RTS (ReTurn from Subroutine) will return control to BASIC.

```
                ;
                ;  OUTPUT ERROR
                ;
                ;
C3C5  20 E7 FF DE    JSR CLALL    ;CLOSE ALL FILES
```

```
C3C8  00                BRK
                        ;
```

Once again: Errors could be worked through in more detail. A BRK to the machine language monitor is not always explanatory.

```
                        ;
                        ;  TRY AGAIN
                        ;
                        ;
C3C9  4C  00  C0  TA    JMP  CS
                        ;
```

To do another file, we go back to the beginning of the program.

```
                        ;
                        ;  FILE COPIED MESSAGE
                        ;
                        ;
C3CC  12                FCM   .BYTE$12
C3CD  20  20  46              .ASC"FILE SUCCESSFULLY
                              COPIED."
C3F2  0D  0D  12              .BYTE$0D,$0D,$12
C3F5  20  20  S0              .ASC"PRESS RETURN TO COPY
                              ANOTHER."
C419  0D  0D  12              .BYTE$0D,$0D,$12
C41C  20  20  S0              .ASC"PRESS ANY OTHER KEY TO
                              STOP."
C43B  0D  0D                  .BYTE$0D,$0D
C43D                    FCML  =   *-FCM
                        ;
```

RAM Limits Are Set

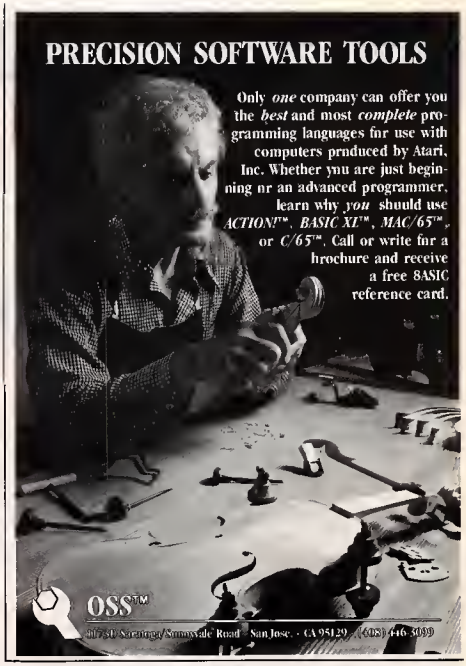
Here are the limits of RAM for the program: They are arbitrarily set to allow space from $4000 to $7F00. I'm not sure why, but it's all right with me.

```
                        ;
C43D  40                SP    .BYTE$40   ;START GOREM
C43E  7F                EP    .BYTE$7F   ;END   GOREM
                        ;
```

The following sequence is intended to initialize the disk. It does it in an unsatisfactory way: It opens the command channel again. (We have already opened the command channel as logical file 15.) The following code sends the BASIC equivalent of OPEN 1,8,15,"I":CLOSE 1. In a moment, I'll give a preferred approach.

```
                        ;
                        ;  INIT DISK
                        ;
                        ;
C43F  A9  01            ID    LDA #INL
C441  A0  C4                  LDY #>IN
C443  A2  SD                  LDX #<IN
C44S  20  BD  FF              JSR  SETNAM
C448  A9  01                  LDA  #1
C44A  A2  08                  LDX  #8
C44C  A0  0F                  LDY  #1S
C44E  20  BA  FF              JSR  SETLFS
C4S1  20  C0  FF              JSR  OPEN
C454  20  CC  FF              JSR  CLRCHN
C457  A9  01                  LDA  #1
C4S9  20  C3  FF              JSR  CLOSE
C4SC  60                      RTS
                        ;
C4SD  49                IN    .ASC "I"
C4SE                    INL   =    *-IN
                        ;
```

What we should be doing is the BASIC equivalent of PRINT#15,"I", which is much easier:




```
ID    LDX  #1S       ;LF 15, command
                      channel
      JSR  $FFC9     ; .. connect to it
      LDA  #"I"      ;Letter I
      JSR  $FFD2     ; .. send it
      JSR  $FFCC     ;disconnect channel
      RTS
```

Error Checking Needs Work

That's the program. It works reasonably well as given. The major improvements I would suggest are additional checking of the disk status (in the program given, the command channel was opened but never used); improved error message procedures; and a little rethinking of the RAM memory allocated.

The program has outstandingly clean documentation; it's a pleasure to read. In the same vein, the messages to the user are good and quite supportive. The coding approach is good, almost classical, in its methodical use of Kernal subroutines. There's a lot to be learned from what's in the program, as well as from what's missing.

I'd like to thank Bud Rasmussen for allowing me to subject his program to analysis, warts and all. It can be embarrassing to have your mistakes—or your style—exposed to public view. I chose to pick through the program in detail because it was well-planned and well-written. Its faults are minor compared to its virtues. C

PROGRAMMING THE TI

C. Regena

TI Graphics

Drawing graphics is one of the things that really make our TI computers fun. Chapter 5 of the *Beginning BASIC* book that comes with your computer tells how you can get going with graphics. Using high-resolution graphics allows you to define your own characters and make detailed drawings on the screen. We can combine high-resolution graphics with text on the same screen, and we can use all 16 colors in high-resolution graphics if we wish.

There are several ways to define the graphics characters; this month we'll look at the most common ways. The CALL CHAR statement defines a certain character number with a certain pattern. If you use a number from 32 to 127, the regular symbol or letter will be redefined.

```
110 CALL CHAR(131,"3838107C10284282
    ")
```

defines character number 131. Notice that the character definition pattern needs to be in quotes.

Using CALL CHAR

Another method is to define a string variable first, then use the CALL CHAR. This can save typing if you have several characters defined with the same shape:

```
150 A$="3838107C10284282"
160 CALL CHAR(128,A$)
170 CALL CHAR(136,A$)
```

If you have a lot of character definitions, DATA statements use less memory than many CALL CHAR statements. The disadvantage is that DATA statements are more difficult to type (and debug). This is an example:

```
200 FOR I=1 TO 10
210 READ C,C$
220 CALL CHAR(C,C$)
230 NEXT I
240 DATA 128,3838107C10284282,129,F
    FFF,130,FFFFFFFFFFFFFFFF,136,83
    E22618186447C1,141,2040408080810
    102,142
250 DATA 2040408080BC936,143,FFFF,1
    44,01020408,145,0,151,FF
```

This loop defines ten characters, but instead of ten CALL CHAR statements, there are only six statements. This method is even more efficient when more graphics characters are defined. Within the loop, line 210 reads two values from the DATA statement (C and C$). Line 220 uses these two values to define character number C with definition C$.

If all your characters are in numerical order, you can use the character number as the loop counter. The DATA statements then contain only the definitions.

```
200 FOR C=97 TO 127
210 READ C$
220 CALL CHAR(C,C$)
230 NEXT C
240 DATA FFFF,,3838107C10284282,E0C
    8 (etc. for all the definitions
    )
```

Zeros Are Assumed

You can define a character with 16 numbers or letters (up to F). If you use fewer, the computer will automatically assume zeros for the rest of the definition. For example, FFFF really means FFFF000000000000. If you want to save memory and typing, arrange your graphics so the zeros are toward the bottom of the square defined. In other words, 0000FFFF00000000 and 000000000000FFFF and FFFF all look the same, but FFFF is the easiest to use. (The "bar" is positioned in different places in the graphics square.)

A character defined as null will be a blank square, or a square of the background color:

```
300 CALL CHAR(130,"")
```

In the DATA statement method, you can have commas with nothing between them:

```
310 DATA FFFF,,F0F
```

The middle definition is null. Both commas are

vital. This particular DATA statement contains three definition strings.

Likely Errors

I mentioned that the data method of defining characters is more difficult to debug. If there is a problem, the most likely message is

```
BAD VALUE IN 220
```

You could also get the message

```
DATA ERROR IN 210
```

or

```
OUT OF DATA IN 210
```

Usually the typing in lines 210 and 220 is fine—the typing error is in the DATA statements. The DATA error messages occur if you don't have the commas placed correctly or if you're reading a string when it should be a number. The BAD VALUE message occurs because the program cannot define the character with what you have read in as data.

The easiest way to find the error is to RUN the program, then when it stops with the error message, print the variables involved. In this case PRINT C,C$ and press ENTER to see what values we have for those variables. You should be able to see exactly what is wrong with your variables. C will tell you how far in the loop you got. Perhaps C$ will have the letter O instead of the number zero, or maybe you've typed a period instead of a comma. In any case, you should be able to spot that error among your DATA statements so it can be corrected.

The CALL CHAR statement only defines the graphics character; you need to put the character on the screen using CALL HCHAR, CALL VCHAR, or PRINT. If a character is already on the screen and you use CALL CHAR to redefine it, all the characters on the screen with that character number will instantly change.

Changes On The Screen

Here's an example of changing character definitions while something is on the screen. Type this short program in, then RUN it.

```
100 PRINT "ABCDABCD"
110 FOR DELAY=1 TO 400
120 NEXT DELAY
130 CALL CHAR(65,"0066660042241 8")
140 FOR DELAY=1 TO 400
150 NEXT DELAY
160 END
```

The screen turns green when the program starts to run, and ABCDABCD is printed on the screen. After a delay loop, line 130 redefines character 65, which is the letter A. All the A's on the screen change. After another delay, the program ends. This technique might be useful to you in game situations when you want to change the graphics quickly.

I use a similar principle to PRINT graphics a little more quickly than using CALL HCHAR or CALL VCHAR (as long as you don't have to worry about scrolling). Redefine as graphics the characters 96 through 126. Now, instead of using several CALL HCHAR statements to put the graphics on the screen, use PRINT with the lowercase letters. Suppose you have a snake defined in six graphics characters, 97 to 102. You can use PRINT "abcdef" to draw the snake on the screen.

Using Lowercase Letters

Release the ALPHA LOCK key to type the lowercase letters (which are actually small capital letters). Use FCTN and the key to type any symbol on the fronts of the keys. The reason you can use characters 96 through 126 so often in programs is that you may rarely need the symbols or lowercase letters in the text within a program.

To use characters from 129 to 159 in this PRINT method, look at the CONTROL KEY CODES list on your Reference Card (or in the Appendix of the *User's Reference Guide*). You can still PRINT graphics and in the quotes use the control key and the appropriate letter for the character number you want. You'll see either a blank or a funny graphics character as you're typing, but it will work fine in the program.

Every so often I read an article complaining that the TI does not have the capability to print graphics using built-in graphics characters or character strings. My rebuttal is that we *do* have the means to PRINT graphics, but we are not limited to graphics shown on the keys (such as on VIC-20, MC-10, or Timex graphics keys). We can define high-resolution graphics any way we wish, then PRINT the graphics using either lowercase letters, symbols, control characters, or CHR$.

Changes For The TI-99/4

A special note to TI-99/4 (square-keyed console) owners: You cannot type in listings using lowercase letters, but a program typed on the TI-99/4A will work on the TI-99/4. If you don't have access to the 4A console, you can convert the PRINT statements by using the ASCII codes of the lowercase letters. 96 is ` (grave), then the lowercase letters start with 97 and go to 122. Instead of PRINT "abcdef", you can use

```
PRINT CHR$(97)&CHR$(98)&CHR$(99)&CHR$(100)
&CHR$(101)&CHR$(102)
```

You may use either the ampersand (&) or semicolons between the character numbers.

Our characters are grouped by eights into character sets which are used in defining colors. We use the CALL COLOR statement to define foreground and background colors for a particular character set—then all characters in that set will be the specified colors. If you need lots of colors on the screen, use different character sets. ©

Commodore Information Handyman

F. Joseph Walker

"Information Handyman" demonstrates some practical uses of data files, and includes a program to keep track of your checking account. Originally written for the VIC with Datassette, the program can also be used on the Commodore 64 and PET/CBM, and can be modified for use with disk.

When data is needed during a program, it is often input from the keyboard or read from DATA statements within the program. Such data is program-dependent, part of the program itself, and therefore not available to other programs. But programs can also use data stored in files. A data file contains information, alphabetic or numeric, that is completely separate from a program. (It's program-independent.) Program-independent files make it possible to share information among several different programs.

Let's say you have computerized your Christmas card list and put the information into a data file. The file contains the names, addresses, cities, states, and zip codes of individuals to whom you will send cards. You can create various programs to manipulate the same information in different ways. For example, you could write one program to sort the names alphabetically, another program to sort by state or zip code, and still another program to search for the mailing information when given a name. You could write an editing program to add, change, or delete names from the list.

Creating A Data File

Let's look at how a data file is created. The general steps are:

1. OPEN a file for data entry.
2. Collect the information to be stored in the file.
3. Write the data to the file.
4. CLOSE the file.

"Information Handyman" illustrates this process by setting up a data file on cassette tape to maintain records of your checking account. Once you understand how the program works, you can easily modify it to handle similar types of information.

Changing Information In The File

Here is some information about the program's operation. Suppose an error was made in an entry when a file was created. Lines 5000–5120 show how the error can be corrected. First, the file must be opened for output, read into memory, and closed. The program then asks for the item to be changed (line 5025) and searches for a match (lines 5030–5040). If the item is not found, the program asks for another item to be changed (line 5045). As with the file creation section, entering STOP for the search item ends the entry process.

The program is set up to search for check numbers, but this can easily be changed. For example, if you changed the C$(R,1) in line 5035 to C$(R$,2), you could search for a particular payee name instead. After all corrections have been made, the file is opened again for writing (line 5090), the entire file is rewritten (lines 5095–5115), and finally the file is closed (line 5120).

Adding Data To The File

As your data base grows, so does the length of your file. Lines 6000–6080 show how data may be added to a previously created file. The original file must be opened, read into memory, and closed by the file-reading routine. When data is added to a sequential file, it is added at the end of the existing data. To add data, the computer must know where the last record is located. The reading routine provides that information in the variable R1. Line 6015 checks to see if the file already contains the maximum number of records. Line 6030 starts the addition at the next available record, R1 + 1.

The new data is entered in lines 6035–6045. As before, entering STOP for the check number will end the entry process. Entry will also end when the maximum 25 entries are made. After all the new entries have been made, lines 6060–6080

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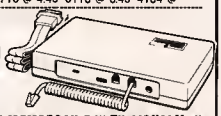

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open the file for writing, write the file (including the new entries), and close the file.

Other Features

The program includes routines to display the records sorted by check number (lines 2000–2060) or by payee name (lines 3000–3050). Both of these use the simple sorting routine in lines 9000–9035. Also included is a routine which will find the payee name and amount when given the check number. As with the correction routine, it would be simple to modify this to search for check number when given the payee name.

Another user-friendly feature is the subroutine at line 9900. This halts the program until you rewind the tape, to insure that you will always begin recording at the start of the file.

Customizing The Program

It may be more efficient to have a separate program for each of the functions, particularly if you have only limited memory, as with the unexpanded VIC. Each of the major routines presented here can be separated into an individual program. Note, however, that most of the routines call other routines. For example, the routine in lines 2000–2055 also needs lines 8000–8040, 9000–9035, and 9900.

The screen displays in the program have been set up for the VIC's 22-column screen. If you are using a 64 or PET/CBM, you can adjust the PRINT statements so that the output will look better on your wider screen display. No other modifications are necessary, but 64 users should remember that the 64 screen display will blank while the program is searching for or reading the file. Also, when the file is found, you'll need to press the Commodore logo key for the reading to proceed.

For unexpanded VICs, not enough memory is available to set up the array for 25 checks. To prevent an OUT OF MEMORY ERROR, you'll have to change the DIM in line 110 to C$(5,3) and the 25 in lines 1025, 6015, 6030, and 8010 to 5. You'll also need to omit spaces everywhere in the program except in the PRINT statements. A file of five records isn't long enough to store a useful amount of information, but it will illustrate the principles of data files. On the other hand, if you have a 64 or PET/CBM, you may have enough memory for arrays of more than 25 rows, and changing the lines mentioned above will allow you to create files with more records.

Disk Modifications

The procedure for creating and manipulating disk data files is essentially the same as that for tape data files. In fact, working with disk files is much easier, since it is not necessary to constantly stop and rewind the tape. Also, the reading and writing is much faster.

To use the program presented here with disk, first delete all the lines which refer to rewinding the tape: 1005, 1010, 2005, 3005, 4005, 5005, 5015, 6005, 6020, and 9900.

These are the lines which must be modified to use the program with a disk drive:

```
1015 OPEN 1,8,8,"0:CHECK INFO FILE,S,W"
5090 OPEN 1,8,8,"@0:CHECK INFO FILE,S,W"
6060 OPEN 1,8,8,"@0:CHECK INFO FILE,S,W"
8005 OPEN 1,8,8,"0:CHECK INFO FILE,S,R"
```

Information Handyman For Commodore

Refer to the "Automatic Proofreader" article before typing this program in.

```
100 PRINT"{CLR}{2 SPACES}{RVS}C H E C K
    {2 SPACES}M E N U{OFF}":CLR   :rem 71
110 DIM C$(25,3):Z$=CHR$(13)      :rem 149
115 PRINT:PRINT "CODE";TAB(5);"FUNCTION":
    PRINT                         :rem 142
120 PRINT" 1 - ENTER CHECK":PRINTTAB(6)"I
    NFORMATION"                   :rem 77
125 PRINT" 2 - DISPLAY IN CHECK":PRINTTAB
    (6)"NO. SEQUENCE"             :rem 96
130 PRINT" 3 - DISPLAY IN PAYEE":PRINTTAB
    (6)"NAME SEQUENCE"            :rem 201
135 PRINT" 4 - FIND PAYEE NAME":PRINTTAB(
    6)"AND CK. AMOUNT             :rem 43
140 PRINT" 5 - CHANGE ITEMS IN":PRINTTAB(
    6)"FILE"                      :rem 16
145 PRINT" 6 - ADD ITEMS TO":PRINTTAB(6)"
    FILE"                         :rem 69
150 PRINT" 7 - END PROGRAM":PRINT:PRINT
                                  :rem 72
155 PRINT"1,2,3,4,5,6, OR 7:";    :rem 246
160 INPUT C1$:C=VAL(C1$):REM C1$=CHOICE
                                  :rem 227
165 IF C<1 OR C>7 THEN 160        :rem 250
170 PRINT"IS ";C1$;" CORRECT{2 SPACES}";:
    INPUT"YES{5 LEFT}";E$         :rem 88
175 IF LEFT$(E$,1)<>"Y" THEN 155 :rem 115
180 ON C GOTO 1000,2000,3000,4000,5000,60
    00,7000                       :rem 22
1000 REM DATA ENTRY               :rem 81
1005 PRINT"{CLR}REMOVE PROG. TAPE AND REP
     LACE WITH FILE TAPE (REWOUND)"
                                  :rem 82
1010 PRINT"TYPE {RVS}CONT{OFF} TO CONTINU
     E":STOP                      :rem 53
1015 OPEN 1,1,1,"CHECK INFO FILE":rem 254
1020 GOSUB 9950                   :rem 26
1025 FOR R=1 TO 25                :rem 121
1030 INPUT"{DOWN}CHECK NO.: ";C$(R,1):IF
     {SPACE}C$(R,1)="STOP" THEN 1055
                                  :rem 159
1035 INPUT"{4 SPACES}PAYEE: ";C$(R,2)
                                  :rem 238
1040 INPUT"{3 SPACES}AMOUNT: ";C$(R,3)
                                  :rem 75
1045 PRINT#1,C$(R,1);Z$;C$(R,2);Z$;C$(R,3
     )                            :rem 247
1050 NEXT                          :rem 5
1055 CLOSE 1:GOSUB 9600:GOTO 100  :rem 255
2000 REM SORT AND DISPLAY BY CHECK NO.
                                  :rem 155
2005 PRINT"{CLR}":GOSUB 9900      :rem 183
2010 GOSUB 8000:REM READ FILE     :rem 101
2015 S=1:GOSUB 9000:REM SORT BY NO.
                                  :rem 216
```

```
2020 PRINT TAB(5);"{CLR}CHECK LISTING"
                                    :rem 56
2025 PRINT TAB(3);"CHECK SEQUENCE":PRINT:
     PRINT                          :rem 117
2030 PRINT"CHECK/AMOUNT";TAB(14);"PAYEE"
                                    :rem 178
2035 FOR R=1 TO R1                  :rem 151
2040 V=VAL(C$(R,3)):V1=V1+V         :rem 252
2045 PRINT C$(R,1),C$(R,2),C$(R,3)
                                    :rem 232
2050 NEXT                            :rem 6
2055 PRINT:PRINT"TOTAL AMOUNT:";V1
                                    :rem 184
2060 GOSUB 9600:GOTO 100             :rem 27
3000 REM SORT ANO DISPLAY BY PAYEE
                                    :rem 231
3005 PRINT"{CLR}":GOSUB 9900        :rem 184
3010 GOSUB 8000:REM REAO FILE       :rem 102
3015 S=2:GOSUB 9000:REM SORT BY PAYEE
                                    :rem 131
3020 PRINT TAB(7);"{CLR}CHECK LISTING"
                                    :rem 59
3025 PRINT TAB(5);"PAYEE SEQUENCE":PRINT:
     PRINT                          :rem 142
3030 PRINT"PAYEE/AMOUNT";TAB(17);"CHECK":
     PRINT                          :rem 125
3035 FOR R=1 TO R1                  :rem 152
3040 PRINT C$(R,2),C$(R,1),C$(R,3)
                                    :rem 228
3045 NEXT R:PRINT:PRINT             :rem 235
3050 GOSUB 9600:GOTO 100             :rem 27
4000 REM FINO PAYEE AND AMOUNT      :rem 228
4005 PRINT"{CLR}":GOSUB 9900        :rem 185
4010 GOSUB 8000:REM REAO FILE       :rem 103
4015 INPUT"{CLR}ENTER CHECK NO.";N$
                                    :rem 133
4020 FOR R=1 TO R1                  :rem 147
4025 IF N$=C$(R,1) THEN 4040        :rem 103
4030 NEXT R                          :rem 88
4035 PRINT "CHECK NO. ";N$;" NOT FOUND IN
      FILE":GOTO 4050               :rem 82
4040 PRINT"{2 DOWN}{2 SPACES}PAYEE :
     {SHIFT-SPACE}";C$(R,2)         :rem 172
4045 PRINT" AMOUNT : ";C$(R,3)       :rem 80
4050 GOSUB 9600:GOTO 100             :rem 28
5000 REM CHANGE FILE DATA           :rem 137
5005 PRINT"{CLR}":GOSUB 9900        :rem 186
5010 GOSUB 8000:REM READ IN FILE    :rem 255
5015 PRINT"FILE IN MEMORY":GOSUB 9900
                                    :rem 184
5020 GOSUB 9950                      :rem 30
5025 INPUT"{DOWN}ITEM TO CHANGE";N$:IF N$
     ="STOP" THEN 5090              :rem 213
5030 FOR R=1 TO R1                  :rem 149
5035 IF N$=C$(R,1) THEN 5050        :rem 107
5040 NEXT                            :rem 8
5045 PRINT"{DOWN}ITEM ";N$;" NOT FOUNO IN
      FILE":GOTO 5025               :rem 110
5050 PRINT"{2 DOWN}CHECK NO.: ";C$(R,1)
                                    :rem 194
5055 PRINT"{4 SPACES}PAYEE: ";C$(R,2)
                                    :rem 241
5060 PRINT"{3 SPACES}AMOUNT: ";C$(R,3)
                                    :rem 78
5065 PRINT:PRINT"ENTER CORRECTIONS:"
                                    :rem 107
5070 INPUT"CHECK NO.";C$(R,1)       :rem 107
5075 INPUT"{4 SPACES}PAYEE";C$(R,2)
                                    :rem 188
5080 INPUT"{3 SPACES}AMOUNT";C$(R,3)
                                    :rem 25
5085 GOTO 5025                      :rem 215
5090 OPEN 1,1,1,"CHECK INFO FILE"    :rem 5
5095 FOR R=1 TO R1                  :rem 160
5100 PRINT#1,C$(R,1)                 :rem 58
5105 PRINT#1,C$(R,2)                 :rem 64
5110 PRINT#1,C$(R,3)                 :rem 61
5115 NEXT R                          :rem 93
5120 CLOSE 1:GOSUB 9600:GOTO 100    :rem 252
6000 REM ADD OATA TO FILE            :rem 80
6005 PRINT"{CLR}":GOSUB 9900        :rem 187
6010 GOSUB 8000:REM READ FILE       :rem 105
6015 IF R1>=25 THEN PRINT"NO MORE DATA CA
     N BE{3 SPACES}ADDED TO FILE":GOTO 60
     80                             :rem 89
6020 PRINT"FILE IN MEMORY":PRINT:GOSUB 99
     00                             :rem 124
6025 GOSUB 9950:PRINT"{DOWN}ADDITION TO F
     ILE"                           :rem 79
6030 FOR R=R1+1 TO 25               :rem 40
6035 INPUT"{DOWN}CHECK NO.: ";C$(R,1):IF
     {SPACE}C$(R,1)="STOP" THEN 6060
                                    :rem 170
6040 INPUT"{4 SPACES}PAYEE: ";C$(R,2)
                                    :rem 239
6045 INPUT"{3 SPACES}AMOUNT: ";C$(R,3)
                                    :rem 85
6050 N=N+1:NEXT R                   :rem 203
6055 PRINT"MAXIMUM NUMBER OF CHECKS ENTER
     ED"                            :rem 213
6060 OPEN 1,1,1,"CHECK INFO FILE"    :rem 3
6065 R1=R1+N:FOR R=1 TO R1          :rem 148
6070 PRINT#1,C$(R,1):PRINT#1,C$(R,2):PRIN
     T#1,C$(R,3)                    :rem 160
6075 NEXT                            :rem 17
6080 CLOSE 1:GOSUB 9600:GOTO 100     :rem 2
7000 REM END OF PROGRAM              :rem 47
7005 PRINT "{CLR}PROGRAM{2 SPACES}TERMINA
     TED"                           :rem 53
7010 END                            :rem 159
8000 REM READ IN DATA FILE          :rem 153
8005 OPEN 1,1,0,"CHECK INFO FILE"    :rem 3
8010 FOR R=1 TO 25                  :rem 122
8015 INPUT#1,C$(R,1):INPUT#1,C$(R,2):INPU
     T#1,C$(R,3)                    :rem 170
8020 IF ST=64 THEN 8030             :rem 161
8025 NEXT R                          :rem 96
8030 CLOSE 1:R1=R                   :rem 190
8035 PRINT:PRINT R1;"RECOROS IN FILE"
                                    :rem 239
8040 RETURN                         :rem 172
9000 REM SORT                       :rem 245
9005 F=0:FOR R=1 TO R1-1            :rem 230
9010 IF C$(R,S)<=C$(R+1,S) THEN 9030
                                     :rem 59
9015 FOR E=1 TO 3                    :rem 63
9020 S$=C$(R,E):C$(R,E)=C$(R+1,E):C$(R+1,
     E)=S$                          :rem 136
9025 NEXT E:F=1                      :rem 66
9030 NEXT R:IF F<>0 THEN 9005        :rem 19
9035 RETURN                         :rem 177
9600 REM WAIT FOR RETURN KEYPRESS   :rem 37
9605 PRINT:PRINT"HIT RETURN FOR MENU"
                                     :rem 77
9610 GET C1$:IF C1$="" THEN 9610     :rem 41
9615 IF C1$<>CHR$(13) THEN 9610      :rem 43
9620 RETURN                         :rem 177
9900 PRINT"REWINO TAPE ANO TYPE{2 SPACES}
     {RVS}CONT{OFF}":STOP:RETURN    :rem 29
9950 PRINT"{CLR}{RVS}{3 SPACES}ENTER STOP
      TO END{6 SPACES}ENTRY{2 SPACES}ROUT
     INE{4 SPACES}{OFF}":RETURN :rem 239
```

MacroDOS For Atari

Part 1

Jerry Allen

This utility will simplify Atari disk operations, allowing you to read the directory and erase files without losing the program in memory.

MacroDOS is an instant access disk utility package for a one- or two-drive DOS 2.0 system. MacroDOS uses only three pages of RAM and therefore can be permanently coresident in memory with the FMS. You can pretty well forget about MEM.SAV. And when you call DOS, you won't have to worry about losing your BASIC or machine language program when you return. The utility can also be used without a cartridge.

MacroDOS supports all the normal DUP functions excepting file and disk duplication, some of which can still be accomplished with the SAVE (binary file) command. Also, MacroDOS incorporates a new feature to DUP systems: hex or dec RUN and address entries, and a permanently available hex-to-decimal, decimal-to-hex converter. You'll have no more lost time looking for that subroutine, which must be around somewhere, or couldn't be loaded anyway because it conflicts with something that is in memory.

You will still be allowed the option of using Atari DUP, but now, before you take that step, the directory can be safely checked to confirm that MEM.SAV is indeed there.

A Safe Location

MacroDOS resides in memory after the FMS, where Atari DUP would normally load. The big difference here is that it pushes MEMLO up to stay out of the way of your programs. You will still have use of page 6, page 4, and even page 1. When SYSTEM RESET or BREAK is hit, MacroDOS will reinitialize itself unless you have exited to Atari DUP, which resets the old vectors.

Some of the MacroDOS operations differ slightly, but if you have used Atari DOS-DUP, there is really little to learn, and you may even find that the new operation is easier to master and execute.

When working with MacroDOS, you should be using DOS.SYS 2.0S in the same (or a smaller) configuration that comes on your master disk. If the listing for the machine language program (Part 2, next month) is used, you should be able to realign the program for larger versions of DOS.SYS using more buffer space. The program will check MEMLO and change everything accordingly.

The program included this month, however, is for BASIC users, and it's constrained to using a version of DOS.SYS which, after it has loaded, has a MEMLO of 7420 ($1CFC), or less. Use the direct mode command as follows to check if in doubt: PRINT PEEK(743)+256*PEEK(744). If your DOS.SYS has not been altered from the master disk, MEMLO will be 7420.

A Few Prompts To Learn

There are a few new prompts. First is the › prompt, which expects the return of a function command's first letter. The directory, format, and write DOS functions use the prompt D# and expect just a single number of 1–4, or just a RETURN, which defaults to drive 1. The format command also uses a ? to ask if you're sure, and looks for a Y or YES before proceeding.

Functions requiring a filename use FN?. The device name (D:, D1:, or D2:) must be included in the name. Rename (RNM) requires only one device name and none for the name after the comma. The @ prompt is used to mean "at" or "to" when an address input is required. Asterisk wild cards are still allowed.

MacroDOS Commands

[D]IR – used to read the disk directory. The second prompt requires a drive number of 1–4 or RETURN only for drive 1.

[R]NM – rename a file. As in Atari DUP, use the device name only with the old name (that is, D3:MAC*.*,AUTORUN.SYS).

[*]LK – lock a file.

[U]n* – unlock a file.

[F]MT – format a disk. Answer SURE? (?) with a Y. Give drive number.

[E]RS – erase file.
[C]RT – return to cartridge; BASIC or Assembler.
[S]AV – save binary file. Enter the filename at the prompt. Do not use commas. Enter the *from* address at the @ prompt. Then the *to* address at the next prompt. The numbers given can be hex or decimal or both, but must be preceded by a $ for hex or a period if decimal. This command allows appending to an existing file if a slash (/) is used after the last letter of the filename. RUN and INIT addresses must be added by appending to a file. POKE (or use command C in DEBUG) 736,737 ($2E0,$2E1) for RUN, and 738,739 ($2E2,$2E3) for INIT. Remember to POKE low, high. Then go to MacroDOS and append the addresses you just changed to the file. Do not hit SRESET between the POKEs and the SAVE or 736–739 will be cleared.

[L]OD – binary load.

[@]RN – run at address. Hex or decimal.

[W]DS – write DOS.SYS (only).

[$]›. – hex to decimal. Enter $ and # together. Range: $00 to $FFFF.
[.]›$ – decimal to hex. Enter a . and # together. Range: .0 to .65535.

[!]DS – escape to Atari DOS (DUP.SYS). Remember that without MEM.SAVE on a disk without write protection in drive 1, programs will be wiped out. After using this command, you'll have to reboot or load from Atari DUP using MEM.SAV. (I don't use the letter A because it's Atari's DUP DIR command and too easy to accidentally use. The ! forces you to shift, and therefore, to think a little more.)

In Part 2, we'll continue the discussion of MacroDOS features, and present the machine language source code.

If you don't want to type in the programs, send $3 and a disk or tape with an SASE mailer.

Jerry Allen
1906 Carnegie #E
Redondo Beach, CA 90278

MacroDOS

Refer to the "Automatic Proofreader" article before typing this program in.

```
MI 20  DIM H$(104):TRAP 95:DPEN #1,8,
       0,"D:AUTDRUN.SYS":FDR N=1 TO 1
       6:READ H$:B=0
HO 30  FOR C=1 TO 99 STEP 2
DP 40  IF H$(C,C+2)="END" THEN GOSUB
       80:END
DH 50  A=16*(ASC(H$(C))-48-7*(ASC(H$(
       C))>57))
OB 60  A=A+ASC(H$(C+1))-48-7*(ASC(H$(
       C+1))>57):B=B+A
MB 70  PUT #1,A:NEXT C:GOSUB 80:NEXT
       N
FN 80  IF B<>VAL(H$(LEN(H$)-3)) THEN
       ? "ERROR AT LINE ";N*100:STOP
EJ 90  RETURN
EF 95  END
NB 100 DATA FFFFFC1C082020AE1E84F288
       8CE3028CE10284FFA280A00586F38
       4F4A03A9848B9A71F20821E68A888
       10F3A9088D5A0320766200
IP 200 DATA 1EA004AD8005D9E21FF01C88
       10F8C944D06DA9068D5A0320741D2
       06A1EA21020761E20701E10F6B9E7
       1F48C9FEF00920951D5209
KE 300 DATA 68206C1E109CA93F20B21E20
       761EAD8005C959D08D20741D30E6A
       94420821EA92320B21E20761EAD80
       058DED1F8DF41FA0064896
OC 400 DATA 89EC1F91F38810F860A94620
       821EA94E20821EA93F20821E4C761
       EC957D01120741DC8B9F31F91F388
       D0F8206A1E1081C94C5965
KH 500 DATA D03485FF20951D4E5A03206A
       1E20991EA9FFC5D4D004C5D5F0F32
       086DD20991E20701F20E61DF0E5AD
       E302F00820051 7A9005814
BD 600 DATA 8DE30260C953D03720951DA0
       FFC881F3C92FD007EE5A03A99B91F
       3C99BD0EE206A1EA9FF85D485D520
       951E20ED1E20951E206602
GK 700 DATA 86DD20ED1E20951E20701F10
       39C940D00620ED1E6CD400C943D00
       34C74E4C921D00EA940850CA91585
       0D2040154C9F17C9244940
AB 800 DATA D0082008 1F20541F100AC92E
       D00620021F202D1F106FA903A210D
       008A200A909D002A9059D4203A91E
       9D4803A9059D4503A93740
EF 900 DATA 809D4403A9009D49032056E4
       302860A908D002A907A2109D4203A
       9029D4803A9009D4503A9D4D0D9A9
       0C108A85D4A200A9084938
QL 1000 DATA 9D4203A90110E3C003F0D1C
       088F0159848A9C520B21E2044DA6
       885D420541F68684CFC1CA5FFF0F
       720E61DADE102F0EF20086297
MC 1100 DATA 17D0EAA94020821E20761EA
       C8005C02EF006C024F008D08D200
       0D84CD2D92044DAA00181F3C998F
       01938E930C90A3002E9075889
IK 1200 DATA A20406D426D5CAD0F905D48
       5D4C810E160A000A201A9F035D44
       A4A4A4A20481FA90F35D420481FC
       A10E83021C90A300269065311
BH 1300 DATA 693091F3C86020AAD920E6D
       8A00081F3C8C98030F9297F8891F
       3C8A99891F34C701EE6D4D002E6D
       5A210A5E09D4403A5E19D7399
CE 1400 DATA 450338A5D4E5E09D4803A5D
       5E5E14C8C1E204015A9FE8DE702A
       91F8DE802A9FC850AA91C8508603
       E98985344A120243EAE205778
GO 1500 DATA 2E3EA4205344D7204E52C02
       0444FCC205641D39B5452C320544
       DC6205352C5204D4ED2202A4ED52
       04B4CAA205249C49B52454936
GN 1600 DATA 2A55462021232 4FE44313A2
       A2E2A9844313A444F532E5359539
       BA991850CA91F850D4C941FE202E
       302FE1FEND0000000000003710
```

VIC And 64 TRACE

Roger Harris

Debugging is far easier if you can watch your program in execution. This program adds a valuable TRACE feature to your debugging toolkit.

Some versions of BASIC have a feature called TRACE, for debugging programs. Apple BASIC has a typical implementation: When the interpreter executes a program with TRACE enabled, the line number of each executed line will be printed on the screen. This allows you to observe the path being taken through your program.

This information can save a great deal of effort in locating logic errors—problems caused by improper program flow. In BASIC, such problems can be caused by using the wrong line number on a GOTO or GOSUB, or by using the wrong variable or conditional test in an IF statement. Tracing, you can determine the first point at which the program begins to behave oddly.

Commodore Upgrade BASIC, used by the VIC-20 and 64, does not have a TRACE. However, the BASIC program presented here will load a machine language (ML) routine which provides the same capability. When the program is run, the ML is read from DATA statements and POKEd into memory. After it's been loaded, you may delete the BASIC program with a NEW command. Now, enter or LOAD your program and RUN it normally.

Taking A TRACE

With the trace routine loaded, a SYS statement may be used to call a subroutine which will enable the trace. The SYS command is always followed by the address of a machine language routine. In this case, the address will depend on where the ML program was loaded, as I shall explain presently. There is another SYS address to disable the trace. You may enter either of the SYS statements before you RUN your program, or they can be statements within the program itself.

The trace produced by the routine will consist of a series of program line numbers, separated by spaces. This display will "wrap" at the end of screen lines, with no attempt to avoid splitting the numbers. Any PRINT output produced by your program will be intermixed with the line numbers.

An unusual feature of this trace is that it will show you the result of each IF statement executed. These results are indicated by printing a T or an F (true or false) after each line number that contained a conditional statement. Statements with multiple conditions will cause a T for each test which is true, or an F for the first condition which is false. It is often very important to know if the conditional part of a statement was executed; this feature gives you an easy way to verify that the program is making its decisions properly.

On the VIC or the 64, you can press the STOP key at any time when your program is running. You will get a message, BREAK IN 150, for example (meaning that the program stopped at line 150), and you will get the READY prompt. You may then resume execution with a CONT (continue) command. When the trace is enabled, you will occasionally find it necessary to use the STOP key to prevent the trace from scrolling off the screen too quickly. In some cases, you may want to add some STOP commands to your program. You can also edit your program to turn the trace on only at critical sections and turn it off for sections which are not under observation. When a program has been STOPped, by the STOP key or command, you may enter any immediate mode statement, such as a PRINT statement to display your variables (?A,B$,F), or a calculation. You may also change the value of variables with assignment statements (for example, X=4). You can still use

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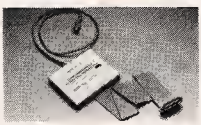

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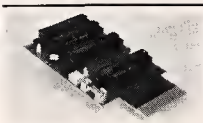

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CONTinue to resume execution, or you can GOTO a particular line number. However, the system will not allow you to CONTinue if you change the program, or if you enter a statement which causes a syntax error. If you edit a statement, you may still use the immediate mode GOTO, but you will have lost the previous value of any variables.

The trace function will not solve all your debugging problems, but obviously you must find a bug before you can fix it. When you can't find a bug by reading the listing, it's time to start investigating, to start TRACEing. You must determine what the program is *really* doing. The PRINT statement and STOP command are the BASIC programmer's primary debugging tools, but a trace is often the fastest way to find problems caused by failure to execute the proper instruction at the proper time.

The Loader Program

The program is a *relocating loader*, which will work on any VIC or 64. The program steals 248 bytes of memory from BASIC to load the machine language routine. The routine will not fit in the cassette buffer. Line 10 of the program PEEKs the current BASIC "limit of memory" from locations 55 and 56, and subtracts 248. (The number PEEKed from 56 is multiplied by 256 because it is the high byte of the two-byte address, and 55 is the low byte.) The address saved at 55 and 56 is the highest address, plus one, of memory available to BASIC. The initial address, minus 248, will be the new top of BASIC memory. Line 15 converts this address back to high byte and low byte. Line 20 POKEs these bytes back into 55 and 56, and does a CLR (clear variables) so that BASIC will recognize the new memory limit. The variable TRACE is then set in line 25 to be the new limit of BASIC. This will be the starting location for POKEing the machine language. If your program needs to allocate some memory for custom characters or screen buffers, you can set 55 and 56 to the required value before you run the loader; the routine will always be POKEd above the "current" limit.

This technique will also work on the 64, but you probably will not have to steal any of BASIC's memory; there is a 4K block of memory starting at 49152 which is not used by BASIC. Unless your program is already using that memory, you can change line 10 to set TRACE=53000 and completely omit lines 15, 20, and 25. 53000 is a particularly good location, since the number is fairly easy to remember, and the routine will use only the last 248 bytes of the 4K RAM. This will leave the beginning of that memory available for programs which use custom characters, sprites, or other ML routines.

Whatever TRACE is located will also be the SYS address which will enable the trace. TRACE plus 24 will be the SYS address which disables the trace. For example, on the unexpanded VIC, TRACE will normally be set to 7432, so SYS 7432 will turn on the trace, and SYS 7456 will turn it off.

All lines from line 30 down should be included in any version of the program. Line 50 of the program is the beginning of a FOR loop which READs the DATA statements. The trace routine is not inherently relocatable; it uses many absolute addresses. Fortunately, all the external (system) addresses used are the same on the VIC and the 64. This leaves only the problem of addresses of internal subroutines and working storage. The loader program does the relocation by checking for negative numbers in the DATA statements; a negative number indicates a place where a two-byte absolute address is required. The address generated will be the absolute value of the negative number, plus the initial value of TRACE. When all the data has been POKEd, the program re-POKEs two locations which are also dependent on TRACE.

As Always, SAVE Before RUN

As always when typing in programs, you must be careful to get all the numbers correct, and you should save a copy of the program before you run it. If any numbers are wrong in the DATA statements, the results will be unpredictable. When it is run, the program adds up the numbers from the DATA statements and compares the total to the correct sum. This will catch most errors, but it is not foolproof. If the sum is correct, the program will say TRACE READY and display the SYS addresses which will enable and disable the trace. Please be very careful when using any SYS statement; there is a high probability that your computer will "lock up" if you use a wrong SYS address. Such a state can only be fixed by turning the power off and then back on.

How Trace Works

The routine which enables the trace places a three-byte JMP (jump) instruction into locations 124, 125, and 126. This overlays the middle of the CHRGET subroutine, which is used by the interpreter to fetch characters from the BASIC program. The destination of the jump is the beginning of the trace handling routine. This technique is sometimes called a *wedge*.

When the trace routine is activated, each fetched character will arrive in the A register. If the byte is a space character, the routine jumps back to CHRGET to get the next. Otherwise, the character is pushed on the stack. Next, the program checks a flag which indicates the presence of a conditional statement. The routine then compares the current line number, stored by BASIC at locations 57 and 58, to the line number which

was last displayed. If a new line is being executed, the new line number is saved for future reference, and is converted from 16-bit binary to ASCII decimal characters for printing. (However, the routine does not output the line number if it is greater than 64000—BASIC puts a high value in the "current line" location when it is interpreting an immediate command.) Each character of the line number is output to the screen by calling the Kernal (operating system) subroutine CHROUT.

The routine then pops the fetched character from the stack, and checks if the character is the BASIC token (one-byte representation) for a THEN. If so, a flag is set. The presence of a THEN indicates a conditional statement which is about to be resolved. I originally thought that the next call to the trace routine could determine if the condition was true or false by checking for a change in the line number. However, BASIC will make one more call to CHRGET even if the condition is false. Therefore, the flag processing is designed to wait for one call before deciding whether to output a T or an F. If the line number has not changed by then, the condition was true.

The routine always returns the fetched character to the interpreter, with the status register (condition codes) set, as CHRGET normally does.

The routine which disables the trace does so by restoring CHRGET to its original state.

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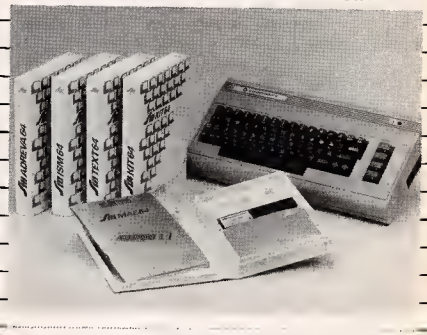

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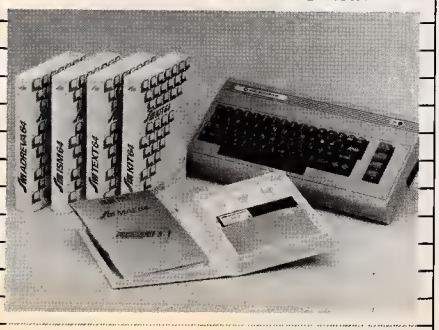

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TRACE

Refer to the "Automatic Proofreader" article before typing this program in.

```
1 REM --- TRACE LOADER              :rem 194
10 LM=PEEK(55)+PEEK(56)*256-248:REM LIMIT
    OF BASIC MEMORY - 248 = NEW LIMIT
                                    :rem 147
15 HI=INT(LM/256):LO=LM-HI*256:REM HIGH A
   ND LOW BYTES OF ADDRESS          :rem 42
20 POKE 55,LO:POKE 56,HI:CLR:REM SET NEW
   {SPACE}LIMIT                     :rem 225
25 TRACE=PEEK(55)+PEEK(56)*256:REM TRACE
   {SPACE}LOAD ADDRESS=NEW LIMIT    :rem 31
30 A=TRACE                          :rem 80
40 PRINT:PRINT"LOADING TRACE ROUTINE AT"
   {SPACE}A                         :rem 101
50 FOR D=1 TO 201:READ N:CS=CS+N:REM READ
    & CHECKSUM CODE DATA            :rem 220
55 REM POSITIVE DATA IS NORMAL BYTE
                                    :rem 116
60 IF N>=0 THEN POKE A,N:GOTO 80    :rem 226
65 REM NEGATIVE DATA IS RELATIVE ADDR, CO
   DE 2 BYTES                       :rem 207
70 N=TRACE+ABS(N):HI=INT(N/256):LO=N-HI*2
   56:POKE A,LO:A=A+1:POKE A,HI     :rem 113
80 A=A+1:NEXT                       :rem 252
85 REM FIX JUMP VECTOR IN INIT CODE
                                    :rem 45
90 HI=INT((TRACE+37)/256):LO=TRACE+37-HI*
   256:POKE TRACE+5,LO:POKE TRACE+9,HI
                                    :rem 39
100 IF CS<>11307 THEN PRINT"DATA ERROR! C
    HECK DATA STATEMENTS!":STOP     :rem 18
```

```
110 PRINT:PRINT"TRACE READY.":PRINT:rem 3
120 PRINT" SYS"TRACE"= TRACE ON"  :rem 95
130 PRINT" SYS"TRACE+24"= TRACE OFF"
                                  :rem 47
140 END                           :rem 108
500 DATA 169,76,133,124,169,8,133,125,169
    ,0,133                        :rem 16
501 DATA 126,169,0,141,-245,141,-246,141
                                  :rem 160
502 DATA-247,96,169,201,133,124,169,58,13
    3                             :rem 79
503 DATA 125,169,176,133,126,96,201,32,20
    8                             :rem 25
504 DATA 3,76,115,0,72,173,-247,240,31,23
    8                             :rem 11
505 DATA -247,201,167,240,24,169,0,141,-2
    47                            :rem 59
506 DATA32,-211,208,4,169,84,208,2,169,70
                                  :rem 20
507 DATA 32,210,255,169,32,32,210,255,32,
    -211                          :rem 149
508 DATA 240,109,165,57,141,-243,141,-245
    ,165                          :rem 165
509 DATA 58,141,-244,141,-246,201,250,176
                                  :rem 221
510 DATA 89,169,0,141,-239,141,-240,141,-
    241                           :rem 101
511 DATA 141,-242,142,-238,162,15,14,-243
                                  :rem 203
512 DATA 46,-244,120,248,173,-239,109,-23
    9                             :rem 19
513 DATA 141,-239,173,-240,109,-240,141,-
    240                           :rem 92
514 DATA 173,-241,109,-241,141,-241,216,8
    8,202                         :rem 200
515 DATA 16,216,162,2,189,-239,72,74,74
                                  :rem 140
516 DATA74,74,32,-224,104,41,15,32,-224,2
    02                            :rem 96
517 DATA 16,236,169,32,32,210,255,174,-23
    8                             :rem 24
518 DATA 104,201,167,208,3,141,-247,201,5
    8                             :rem 11
519 DATA 176,3,76,132,0,96,165,57,205,-24
    5                             :rem 31
520 DATA 208,5,165,58,205,-246,96,205,-24
    2,208                         :rem 218
521 DATA 1,96,9,48,141,-242,76,210,255
                                  :rem 78 ©
```


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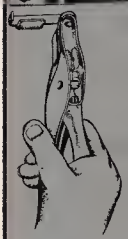

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Apple Variable Save

Jeff Brewster

Modifying lines in Applesoft BASIC programs can be time-consuming when variables are lost. Here is a machine language program to solve that problem. It saves and automatically resets pointers to variables, letting you easily interrupt programs for modification and debugging.

In Applesoft BASIC you will lose variables whenever a program is modified. This is especially troublesome during program development and debugging when many changes must be made and their effects determined. Each time a line is changed, it is necessary to reexecute the entire program due to the loss of variables. When the program involves long calculations or many operator INPUTS, this requirement makes program modification a slow, frustrating process.

By using this short machine language program "VARSAV," you can avoid much of this trouble. A running program can be interrupted with CTRL-C or RESET; program lines can be modified, added, or deleted; and execution can be resumed with the CONT or GOTO command. All the variables will still be there, ready to use (provided no unusual commands are entered which would disturb the stored variables or their pointers—these forbidden commands are discussed below).

Programming Considerations

This modification to BASIC is implemented by having Applesoft call VARSAV when keyboard input is required, instead of the usual routine KEYIN. VARSAV consists of two parts: the functional part of the program and a short initialization sequence which must be run to connect VARSAV to Applesoft. The initialization routine sets the KSW pointer at $38–$39 so that VARSAV is called when keyboard input is required; it also patches a new routine into the RESET sequence so that VARSAV remains connected even after a system RESET. START calls KEYIN to read the keyboard and then saves or restores certain pointers which tell Applesoft where variables are located in memory.

VARSAV occupies 96 bytes, including the seven-byte storage area RSAVE, and can be located anywhere in memory. The program is entered most quickly from the monitor (CALL-151) using the hex dump in Program 1. It is convenient to type in the program as written, list it to find errors, and then make any location-dependent changes.

The main program is in page 3 of memory (*pages* are 256-byte groupings), a usually vacant area, while allowing the initialization routine to reside at the top of page 2. This keeps the initialization sequence, which is used only once, out of valuable page 3 memory space.

VARSAV is conveniently implemented on a disk system by including a BRUN VARSAV instruction in the greeting program so that VARSAV will be loaded and run whenever the disk is booted. The use of VARSAV is straightforward and nearly transparent to the operator. You needn't grasp the program's operation to use VARSAV, so skip the next section if the details do not interest you.

Saving And Restoring Variables

Variables are stored by Applesoft in tables, starting at the end of the program and moving up in mem-

ory. Simple variables are stored in the lower segment of the variable space; array variables are in the upper segment. As new variables are defined, they are added to the end of the existing tables. String variables are actually stored in two places: the name of the string and a pointer are stored in the appropriate variable table (simple or array), while the string itself is stored at the top of available memory. New strings are added at the top of memory, working down, while their pointers are stored in the variable table, working up.

To keep track of the variables, Applesoft has four pointers in zero page ($69 to $70, 105 to 112 decimal) which define the start of the simple variable table, the start of the array variable table, the end of variable storage, and the start of string storage. Their functions are described more fully on page 140 of the *Applesoft II Reference Manual*.

The first pointer is set automatically to the end of the program by Applesoft when the program is loaded, or by entering or deleting a program line. This pointer can be changed to a higher value with LOMEM or a POKE, permitting the programmer to leave a space in memory between the program and the variable tables. The other pointers are not directly accessible.

At the beginning of a program, the second and third pointers are set equal to the first, while the fourth pointer is set equal to HIMEM. As variables are assigned by the program, the pointers are updated. Since variables are never deleted from the variable tables, the pointers never decrease in value during program execution. When a new line is entered, however, these pointers are reset to their initial (default) values, so that it appears to Applesoft that no variables have been defined. The variables and strings themselves are still in memory waiting to be used—Applesoft just doesn't see them.

If the pointers could be saved somewhere before they were reset, and then restored after the new line input, Applesoft would then be able to use the variables already assigned. This could be done by using the monitor M command (Move) to store the pointers in a convenient location, returning to BASIC to make program changes, and then using the monitor again to restore the variable pointers from the storage area before continuing execution. VARSAV simply performs these operations automatically via the routines SAVE (save pointers) and RESTOR (restore pointers) each time the keyboard is read.

The appropriate operation is selected by comparing the current value of the pointer to the end of variable storage ($6D–$6E) to the stored value of this pointer. If the stored value is less than the current pointer value, a SAVE operation is performed; a RESTOR operation occurs if the current pointer value is less than the saved value. Generally, this means that when the pointers are updated they are SAVEd the next time keyboard input is requested. RESTOR occurs after keyboard input only if the variable pointers have been reset to their default values.

VARSAV makes this comparison each time the keyboard is read unless the character entered is CTRL-C. In that case, a SAVE operation is performed regardless of the current value of the variable pointers. This exception is necessary in order to permit the variable tables to be cleared. To clear the variables, enter the CLEAR command (then carriage return) followed immediately by CTRL-C.

Program Modification And RESET

How to use VARSAV is best learned by considering the sample program "VARSAV Test" (Program 2). Assume that VARSAV is in effect and that VARSAV Test is RUN. Execution will halt at statement 110 with a SYNTAX ERROR due to the misspelled NEXT. At this point the storage area holds the default values of the variable pointers, while the pointers themselves contain the current values assigned by Applesoft. These values must be saved before changing line 110. Entering the following line (or hitting any key) will accomplish this:

```
110 NEXT I
```

As the first character of the line is entered, a SAVE operation is performed, preserving the variable pointers. When you hit RETURN, Applesoft will process the line, checking the first nonblank character to determine whether this is an immediate mode command or new program line input. Since the first character is a number, the line is treated as new line input, and Applesoft clears the variable pointers to their default values and stores the new line in memory.

Suppose the command GOTO 90 is entered next. When the G is entered from the keyboard, VARSAV will test the end of variable space pointer and determine that its (default) value is less than the stored value. This results in a RESTOR operation which sets the variable pointers back to their original (correct) values. The variables will be printed out as if there were no changes made in the program at all.

To further complicate things, the effect of the RESET key has to be reckoned with. As mentioned previously, VARSAV is called via the KSW vector at $38–$39. Applesoft makes an indirect jump to the address held by the KSW vector whenever keyboard input is required. VARSAV sets the KSW vector to point to itself instead of the normal input routine KEYIN.

When RESET is hit, a number of operations occur which set the Apple's video output, I/O vectors, and soft switches to defined states. The

RESET sequence ends with an indirect jump to the address held in the soft entry vector (SOFTEV) at $3F2–$3F3, which returns control to the current operating language. As part of the sequence, the KSW vector is changed to its default value (pointing to KEYIN), thus disconnecting VARSAV.

To counter this, VARSAV sets the soft entry vector to cause a jump to its own reset routine, which reconnects VARSAV via the KSW vector, and then exits normally to BASIC.

The task of setting these two vectors (KSW and SOFTEV) is even more complicated when DOS is present. DOS is also connected to Applesoft through the KSW vector, and calls to VARSAV must be routed through DOS. In addition, DOS must set its own pointers after a system RESET just as VARSAV must. Thus, VARSAV must pass the value of KSW to DOS, and warmstart DOS (and BASIC) after a system RESET.

As was mentioned, only the pointers, not the variables themselves, are lost when program changes are made. This is true only when the change does not lengthen the program. If the program is lengthened, the lower end of the variable table will be overwritten by program lines and permanently lost.

This problem is easily avoided by using LOMEM to establish a space in memory between the end of the program and the start of the variable tables. This space is then available for additional program line storage without disturbing the variables. A space of 256 bytes is adequate for about eight BASIC lines; such a space is easily allocated by using the following statement as the first line of each program:

```
1 LOMEM : PEEK (105) + PEEK (106)*256 + 256
```

If many changes are anticipated, the space can be made larger by increasing the last value in line 1. A more compact equivalent statement is:

```
1 POKE 106, PEEK (106) + 1
```

Again, the space can be increased in 256-byte increments by increasing the last value in the line.

Using VARSAV

Once VARSAV has been loaded into memory, start the program from the beginning to set the KSW and SOFTEV vectors. The program as presented can be started with CALL 755. If the program is relocated, start it using a CALL to the first byte of the program. Load or enter a BASIC program as usual (try Program 2 the first time). Before running the program, enter CLEAR followed by CTRL-C to initialize the storage registers; then set LOMEM at least several hundred bytes beyond the end of the program to allow room in memory for added program lines. This can be done by entering LOMEM from the keyboard, or by incorporating one of the statements found in the previous paragraph, into the program.

Start execution as usual with RUN or GOTO. The program can be interrupted at will, changed, and execution will still continue without any loss of variables. Problems with VARSAV will occur if commands are entered from the keyboard which alter the variable tables or their pointers. Changing HIMEM or LOMEM may do this. Changing LOMEM will have no effect unless followed by CTRL-C, in which case all variables are lost; changing HIMEM will affect only strings.

Of course, altering HIMEM or LOMEM can destroy variables whether VARSAV is in use or not, so these commands should never be used after variables have been assigned in a program. Another problem can result if a program is run when the pointer storage area of VARSAV contains garbage, or pointer values from another program. The CLEAR, CTRL-C sequence described above should always be used to clear the pointer storage area before running a program.

This could also be done automatically by placing the following line at the beginning of each program:

```
2 CLEAR : CALL 808
```

With these simple precautions in mind, VARSAV can make programming and debugging in Applesoft a more pleasant, a faster job.

Program 1: Hex Dump Of VARSAV

```
02F0- 00 00 00 A9 45 A0 03 8D
02F8- F2 03 8C F3 03 20 6F FB
0300- A9 0B A0 03 85 38 84 39
0308- 4C EA 03 84 F9 20 1B FD
0310- 85 FA C9 83 F0 12 A5 6E
0318- CD 50 03 90 1B D0 09 A5
0320- 6D CD 4F 03 90 0F F0 1B
0328- A0 07 B9 69 00 99 4B 03
0330- 88 10 F7 30 0B A0 07 B9
0338- 4B 03 99 69 00 88 10 F7
0340- A4 F9 A5 FA 60 20 00 03
0348- 4C BF 9D 00 00 00 00 00
```

Program 2: VARSAV Test

```
10  REM  VARSAV TEST
20  LOMEM:  PEEK (105) +  PEEK (106) *
     256 + 256
30  CLEAR : CALL 808: REM  SAVE ROUTINE
     AT $328
40 A = 1:B = 2:C = 3
50 A$ = "A":B$ = "B":C$ = "C"
60  FOR I = 1 TO 10
70 ARRAY(I) = I
80  NEXT I
90  FOR I = 1 TO 10
100  PRINT ARRAY(I)
110 NEST1: REM  THAT'S RIGHT!
120  PRINT
130  PRINT A,B,C
140  PRINT
150  PRINT A$,B$,C$
160  REM  TRY CHANGING THIS LINE
```

Graphics 0 Text In Four Colors

Ted Baldwin

Add four-color text to your Atari screen displays. These five programs demonstrate the ANTIC 4 display mode and allow you to save redefined characters for use in other programs.

ANTIC 4 is a little-known Atari display mode. Similar to GRAPHICS 0, it is a character mode, with 40 columns and 24 lines per screen, and uses all 256 characters. However, it also has the capability to display characters in four colors.

This is a result of the way ANTIC 4 interprets the character pattern. GRAPHICS 0, for instance, reads the character pattern one bit at a time. Each bit corresponds to one pixel of the character on the screen. The 1 bits are displayed at a different brightness than the 0 bits. ANTIC 4, on the other hand, reads the pattern two bits at a time. Each bit-pair corresponds to one pixel of the character. There are four possible combinations of two bits: 00, 01, 10, 11. Each combination represents a different color. The color corresponding to the bit-pair 00 is stored at location 712; the color for the bit-pair 01 is at location 708; the color for bit-pair 10 is at 709; the color for bit-pair 11 is at 710.

Redefined Characters

Program 1 converts the display to ANTIC 4. Running the program will reveal one of the drawbacks of ANTIC 4: The normal character set is useless. The characters on the screen are garbled because the normal character patterns are not designed to be read in bit-pairs. In order to make any practical use of ANTIC 4, you must redefine the character set.

Program 2 does that. The bit pattern for each character is designed so that the characters will appear in different colors. Specifically, typing lowercase letters will display light blue uppercase letters; typing uppercase letters will display gray uppercase letters; typing a number will display that number in gray; typing a shifted number will display that number in blue-green.

Program 3 demonstrates the use of these characters in ANTIC 4. Be sure to run Program 2 before running Program 3. The program first displays normal GRAPHICS 0 text. Then it switches to ANTIC 4 and displays four-color text using the redefined character set. The colors are changed to orange, green, and blue-green on a pink background.

Program 4 saves the redefined character set to disk and should be run after Program 2. Program 5 loads the character set back in. Your own filename can be substituted in line 140 of both programs.

You can add four-color text to your own programs by using Program 5 to load the character set and Program 1 to switch to ANTIC 4. Besides making your programs more colorful, these routines enable you to highlight important messages.

Refer to the "Automatic Proofreader" article before typing these programs in.

Program 1: The Original Characters

```
ED 10 DL=PEEK(560)+256*PEEK(561)
GM 20 POKE DL+3,PEEK(DL+3)+2
IJ 30 FOR I=DL+6 TO DL+28
DM 40 POKE I,4
DN 50 NEXT I
```

Program 2: Redefining The Characters

```
DP 30105 REM FIND TOP OF RAM MEMORY
DC 30110 TOP=PEEK(106)
NC 30115 REM LOWER MEM TOP TO MAKE SAF
         E{8 SPACES}LOCATION FOR CHARA
         CTER SET
HD 30120 LOWTOP=TOP-5:POKE 106,LOWTOP
BD 30125 REM MOVE SCREEN MEMORY TO REF
         LEC{6 SPACES}T NEW MEM TOP
IK 30130 GRAPHICS 0:? "PlEaSe WaIt ":S
         ETCOLOR 4,4,4:SETCOLOR 1,0,2:
         SETCOLOR 0,8,8
NG 30135 REM Z IS POINTER TO SUBROUTIN
         E.{7 SPACES}CS IS CHAR. SET S
         TART ADDRESS
AD 30140 Z=30800:CS=256*(TOP-4)
IK 30145 REM READ IN COLOR #1 LETTERS
GI 30150 H=CS+264:J=H+207:L=30300:K=1:
         GOSUB Z
IM 30155 REM READ IN COLOR #2 LETTERS
AD 30160 H=CS+520:J=H+207:K=1.5:GOSUB
         Z
IL 30165 REM READ IN COLOR #0 LETTERS
NM 30170 H=CS+776:J=H+207:K=0.5:L=3056
         0:GOSUB Z
IG 30175 REM READ IN COLOR #1 NUMBERS
```

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```
EK 30180 H=CS+128:J=H+79:K=1:L=30570:G
         OSUB Z
II 30185 REM READ IN COLOR #2 NUMBERS
JG 30190 H=CS+8:J=H+55:K=1.5:L=30650:G
         OSUB Z:H=CS+64:J=H+7:L=30560:
         GOSUB Z:H=CS+72:J=H+7:L=30640
         :GOSUB Z
BI 30200 H=CS+256:J=H+7:L=30560:GOSUB
         Z
HP 30205 REM READ IN COLOR #0 NUMBERS
IF 30210 H=CS+80:J=H+15:K=0.5:L=0:GOSU
         B Z:H=CS+104:J=H+7:GOSUB Z:H=
         CS+120:J=H+7:GOSUB Z:H=CS+224
         :J=H+23:GOSUB Z
IH 30220 H=CS+472:J=H+23:GOSUB Z
OA 30235 REM READ IN SPACE CHARACTERS
GO 30240 H=CS:J=H+7:GOSUB Z:H=CS+496:J
         =H+23:GOSUB Z
NK 30300 DATA 4,1,2,3,3,2,3,4
NM 30310 DATA 4,2,3,2,3,3,2,4
OC 30320 DATA 4,2,3,5,5,3,2,4
OH 30330 DATA 4,6,3,3,3,3,6,4
OF 30340 DATA 4,2,5,2,5,5,2,4
OJ 30350 DATA 4,2,5,2,5,5,5,4
OG 30360 DATA 4,2,5,5,3,3,2,4
OE 30370 DATA 4,3,3,2,3,3,3,4
NM 30380 DATA 4,2,1,1,1,1,2,4
PG 30390 DATA 4,7,7,7,7,3,2,4
OA 30400 DATA 4,3,3,2,6,2,3,4
OJ 30410 DATA 4,5,5,5,5,5,2,4
NO 30420 DATA 4,3,2,2,2,3,3,4
OA 30430 DATA 4,3,2,2,3,3,3,4
OB 30440 DATA 4,2,3,3,3,3,2,4
OG 30450 DATA 4,2,3,3,2,5,5,4
OG 30460 DATA 4,2,3,3,3,3,2,7
OO 30470 DATA 4,2,3,2,2,3,3,4
OO 30480 DATA 4,2,5,2,7,7,2,4
NN 30490 DATA 4,2,1,1,1,1,1,4
NP 30500 DATA 4,3,3,3,3,3,2,4
NO 30510 DATA 4,3,3,3,3,2,1,4
OA 30520 DATA 4,3,3,3,2,2,3,4
NP 30530 DATA 4,3,3,1,1,3,3,4
NN 30540 DATA 4,3,3,2,1,1,1,4
OF 30550 DATA 4,2,7,1,1,5,2,4
OE 30560 DATA 4,2,3,3,3,3,2,4
OB 30570 DATA 4,6,1,1,1,1,2,4
PE 30580 DATA 4,2,7,8,6,5,2,4
PC 30590 DATA 4,2,7,2,7,7,2,4
PB 30600 DATA 4,7,8,3,2,7,7,4
OF 30610 DATA 4,2,5,2,7,3,2,4
OC 30620 DATA 4,2,5,2,3,3,2,4
OH 30630 DATA 4,2,7,1,1,5,5,4
OC 30640 DATA 4,2,3,2,3,3,2,4
PA 30650 DATA 4,2,3,2,7,7,7,4
ON 30660 DATA 4,4,4,4,4,4,4,4
BG 30670 DATA 9,9,9,9,9,9,9,9
FH 30680 DATA 10,10,10,10,10,10,10,10
GA 30690 DATA 11,11,11,11,11,11,11,11
BO 30695 REM TELL ATARI CHAR.SET LOCAT
         ION
EL 30700 POKE 756,TOP-4
BE 30705 REM SETUP FOR ANTIC 4 DISPLAY
FF 30710 DL=PEEK(560)+256*PEEK(561):PO
         KE DL+3,PEEK(DL+3)+2:FOR I=DL
         +6 TO DL+28:POKE I,4:NEXT I
ND 30720 END
II 30795 REM SUBROUTINE TO READ DATA I
         NTO{6 SPACES}CHARACTER SET
QL 30800 FOR I=H TO J:READ G:ON G GOSU
         B Z+20,Z+30,Z+40,Z+50,Z+60,Z+
         70,Z+80,Z+90,Z+100,Z+110,Z+12
         0:NEXT I
FH 30805 IF L=0 THEN RETURN
IG 30810 RESTORE L:RETURN
JF 30820 POKE I,32*K:RETURN
NA 30830 POKE I,168*K:RETURN
MM 30840 POKE I,136*K:RETURN
AN 30850 POKE I,0:RETURN
MP 30860 POKE I,128*K:RETURN
MM 30870 POKE I,160*K:RETURN
GO 30880 POKE I,8*K:RETURN
JL 30890 POKE I,40*K:RETURN
CH 30900 POKE I,85:RETURN
FO 30910 POKE I,170:RETURN
FI 30920 POKE I,255:RETURN
```

Program 3: ANTIC 4 Demonstration

```
LG 5 GRAPHICS 0
KG 10 POSITION 15,10:? "{13 ■■■■■■■}"
QI 20 POSITION 15,11:? "■ ■ ■ ■ ■ ■ ■"
MK 30 POSITION 15,12:? "■{11 SPACES}■"
BN 40 POSITION 15,13:? "■  GRAPHICS ■"
MD 50 POSITION 15,14:? "■{11 SPACES}■"
AA 60 POSITION 15,15:? "■{5 SPACES}0
      {5 SPACES}■"
NC 70 POSITION 15,16:? "■{11 SPACES}■"
PE 80 POSITION 15,17:? "■ ■ ■ ■ ■ ■ ■"
LG 90 POSITION 15,18:? "{13 ■■■■■■■}"
OR 95 FOR I=0 TO 1000:NEXT I
IL 100 DL=PEEK(560)+256*PEEK(561):POKE
       DL+3,PEEK(DL+3)+2:FOR I=DL+6 T
       O DL+28:POKE I,4:NEXT I:POKE 75
       6,PEEK(106)+1
DP 110 SETCOLOR 4,4,2
LI 120 POSITION 15,10:? "{13 ,}"
EP 130 POSITION 15,11:? "{,}_■_■_■_■
       _{,}"
LM 140 POSITION 15,12:? "{,}
       {11 SPACES}{,}"
LO 150 POSITION 15,13:? "{,}
       {11 SPACES}{,}"
JO 160 POSITION 15,14:? "{,}  AnTiC $
       {,}"
MC 170 POSITION 15,15:? "{,}
       {11 SPACES}{,}"
ME 180 POSITION 15,16:? "{,}
       {11 SPACES}{,}"
FL 190 POSITION 15,17:? "{,}_■_■_■_■
       _{,}"
LP 200 POSITION 15,18:? "{13 ,}"
BC 210 FOR I=0 TO 2000:NEXT I:GRAPHICS
       0
```

Program 4: Save Character Set

```
FO 110 CHSET=PEEK(756)
IF 120 CHSET=CHSET*256
GE 130 TRAP 180
BC 140 OPEN #1,8,0,"D:CHSET":REM YOUR
       FILENAME HERE
JM 150 FOR I=0 TO 1023
GK 160 A=PEEK(CHSET+I):PUT #1,A
CA 170 NEXT I
GO 180 CLOSE #1
```

Program 5: Load Character Set

```
LB 105 POKE 106,PEEK(106)-4:GRAPHICS 0
JM 110 POKE 756,PEEK(106)
BL 120 CHSET=256*PEEK(106)
GE 130 TRAP 180
AO 140 OPEN #1,4,0,"D:CHSET":REM YOUR
       FILENAME HERE
JM 150 FOR I=0 TO 1023
PJ 160 GET #1,A:POKE CHSET+I,A
CA 170 NEXT I
GO 180 CLOSE #1
```

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Atari TAB

Stephen Levy, Editor, COMPUTE! Books

Atari BASIC has no built-in TAB or SPC functions. Here are four ways you can set up TABs.

Although there are no TAB or SPC functions built into Atari BASIC, the functions do exist. It is true that these functions are somewhat less convenient than those found in other BASICs, but they are no less powerful.

Most Atari users overcome the need for a TAB by using the POSITION statement. The POSITION statement is similar to the TRS-80 command PRINT AT. The short program below will illustrate how the POSITION statement works.

```
10 PRINT CHR$(125)
20 FOR X=0 TO 20
30 POSITION X,X:PRINT X
40 NEXT X
```

Two zero page locations are useful when the TAB function is needed. The following program accomplishes the same task as the previous program, but uses a POKE to location 85.

```
10 PRINT CHR$(125)
20 FOR X=0 TO 20
30 POKE 85,X:PRINT X
40 NEXT X
```

The number POKEd into 85 is the actual column to which the cursor is moved. If the cursor is at column 30 and the computer encounters a POKE to 85 less than 30, the cursor will move to the next line. The cursor will not move to the specified location until something is actually printed on the screen.

The second useful page zero location is 201. Location 201 contains a 10 when the Atari is turned on, which means that the tabs have been set to 10. By POKEing another number into this location, we can change the tab settings. Placing a comma after a PRINT statement will cause the next PRINT statement to print at the next available tab stop.

Try this:

```
POKE 201,15:PRINT "COMPUTE!","Magazine"
```

Notice how the words have been separated. The next example will help you understand how different numbers POKEd into 201 will affect the tab stops. The program will accept only numbers from 4 to 29.

```
10 PRINT CHR$(125)
20 TRAP 20:PRINT "HOW MANY SPACES BE
   TWEEN TAB STOPS";:INPUT TAB
30 IF TAB<4 OR TAB>30 THEN 20
40 POKE 201,TAB
50 PRINT :PRINT "POKE 201,";TAB
60 COL=PEEK(85):PRINT COL,
70 IF COL+TAB>38 THEN 90
80 GOTO 60
90 PRINT :GOTO 20
```

If you POKE 201,1 the computer will leave three spaces. Likewise, POKE 201,2 will leave four spaces. POKE 201,0 will cause problems when the next PRINT statement with a comma is encountered.

Spaces

Perhaps the simplest method of leaving spaces between prints is to put spaces within quotes. This may be the preferred method when spacing is used just a few times within a program. However, when this method is needed often within a program and the number of spaces will vary, it may be convenient to create a string of 38 spaces. Once the string is created, you need to call only the number of spaces required.

```
10 DIM SPC$(38):SPC$=" ":SPC$(38)=SP
   C$:SPC$(2)=SPC$
20 PRINT "15";SPC$(1,15);"spaces"
```

Nicely Formatted Names

Let's assume you wish to create a listing of names, nicely formatted on the screen. You can use any one of the methods discussed here. Each program

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below uses one of these methods, but all create the same screen display.

Program 1: TAB Using POKE 201

```
10 PRINT CHR$(125):POKE 201,13
20 DIM NAME$(10),ADDRESS$(25)
30 PRINT "NAME","{3 SPACES}ADDRESS"
50 PRINT
60 FOR A=1 TO 4
70 READ NAME$,ADDRESS$
80 PRINT NAME$,ADDRESS$
90 NEXT A
100 END
110 DATA ADAMS,12 MAIN STREET
120 DATA ARTHUR,1515 SUNNY STREET
130 DATA SMITHSON,100 CIRCLE DRIVE
140 DATA WEEKS,2 DDNNA LANE
```

Program 2: TAB Using A String Of Spaces

```
10 PRINT CHR$(125)
20 DIM SPC$(38),NAME$(10),ADDRESS$(2
   5)
30 SPC$=" ":SPC$(38)=" ":SPC$(2)=SPC
   $
40 PRINT "NAME";SPC$(1,12);"ADDRESS"
50 PRINT
60 FOR A=1 TO 4
70 READ NAME$,ADDRESS$
80 PRINT NAME$;SPC$(LEN(NAME$),12);A
   DDRESS$
90 NEXT A
100 END
110 DATA ADAMS,12 MAIN STREET
120 DATA ARTHUR,1515 SUNNY STREET
130 DATA SMITHSDN,100 CIRCLE DRIVE
140 DATA WEEKS,2 DDNNA LANE
```

Program 3: POSITION Example

```
10 PRINT CHR$(125)
20 DIM NAME$(10),ADDRESS$(25)
40 PRINT "NAME":PDSITIDN 18,1:PRINT
   "ADDRESS"
50 PRINT
60 FOR A=1 TD 4
70 READ NAME$,ADDRESS$
80 PRINT NAME$:POSITION 14,A+2:PRINT
    ADDRESS$
90 NEXT A
100 END
110 DATA ADAMS,12 MAIN STREET
120 DATA ARTHUR,1515 SUNNY STREET
130 DATA SMITHSDN,100 CIRCLE DRIVE
140 DATA WEEKS,2 DDNNA LANE
```

Program 4: POKE 85 Example

```
10 PRINT CHR$(125)
20 DIM NAME$(10),ADDRESS$(25)
40 PRINT "NAME";:PDKE 85,18:PRINT "A
   DDRESS"
50 PRINT
60 FOR A=1 TD 4
70 READ NAME$,ADDRESS$
80 PRINT NAME$;:PDKE 85,15:PRINT ADD
   RESS$
90 NEXT A
100 END
110 DATA ADAMS,12 MAIN STREET
120 DATA ARTHUR,1515 SUNNY STREET
130 DATA SMITHSDN,100 CIRCLE DRIVE
140 DATA WEEKS,2 DONNA LANE
```

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Garbage Collection On Commodore Computers

Part 1

Jim Butterfield, Associate Editor

There's a sneaky event lying in wait for you within most Commodore machines. It's called garbage collection, *and it will show up, seemingly unpredictably, in any of several ways. Your program may seem to run slowly or erratically in "spurts." The program may have frequent pauses, each of which lasts several seconds. Worst of all, the program may pause for much longer periods of time—a minute, ten minutes, or even longer—and will seem to have "crashed." The user might be tempted to turn the machine off, thinking that it has failed.*

The garbage collection phenomenon isn't limited to Commodore machines, of course. Much of what is said here may be applied to other computers. The specific remedies that will be given for VIC, 64, PET, and CBM can be adapted to suit the different logic of other machines. Conversely, not all Commodore machines have garbage collection problems; for example, machines identifying themselves as 4.0 won't have these delays.

An Example

Try this on your computer:

```
100 DIM A$(800)
110 FOR J=1 TO 800
120 A$(J)=CHR$(65)
130 NEXT J
140 PRINT "X"
150 PRINT FRE(0)
160 PRINT "Y"
```

It will take a few moments to perform the loop in lines 110 to 130. You would expect this. But unless you know about garbage collection, you won't expect much of a delay in the last three lines; after all, they are just PRINT statements.

Try it. If there's a delay between printing X and Y, that's a garbage collection pause.

To illustrate the odd nature of garbage collection, try this: Change line 120 to read A$(J)="A"—this is the same thing, of course, since CHR$(65) is the letter A. But this time the delay disappears when you run the program.

Why It Happens

When a program assigns a value to a string variable, it may do so in either of two ways. If the string exists completely within the program, it will be used "where it lies"; there's no need to make a copy. For example, a program statement such as 500 X$="HELLO" will use the string HELLO right out of the program where it lies. Similarly, the statements: 800 DATA COFFEE and 900 READ R$ will cause the string COFFEE to be used from within the DATA statement; it won't be moved to any other place in memory. There doesn't seem to be a name for this kind of string: I'll use the term *static string* to refer to a string used directly from its place within a program.

On the other hand, some strings can't be used this way. If I create a string with an INPUT statement or by using a string manipulation command such as STR$( ) or CHR$( ), the computer must find a place to put this newly formed string. This kind of string must be packed away into a *string storage area.* I'll use the term *dynamic string* to refer to strings of this type.

Now, let's suppose that a running program creates a dynamic string with the statement INPUT A$. The user types in the string—say, EBENEEZER—which will be packed into the string

storage area. Later, the program loops and asks for more input with INPUT A$, and the user now types in MARY. MARY, too, gets packed into the string storage area; but even though Ebeneezer is no longer needed (he's been replaced by Mary), the old string is not erased. Instead it lies dead in memory—as garbage.

Let's talk for a moment about the string storage area. It's located near the top of available BASIC memory: above the program, above the variables, and above the arrays. Dynamic strings are placed at the top of this area. As more and more strings are created, they work their way downward. Often, many discarded strings will be left behind—Ebeneezer and his friends—yet no attempt is made to reclaim the wasted space.

This type of thing continues until the dynamic strings bump into the top of BASIC, variables, and arrays. At that time, the waste space must be cleaned up; hence, "garbage collection."

Bad Timing

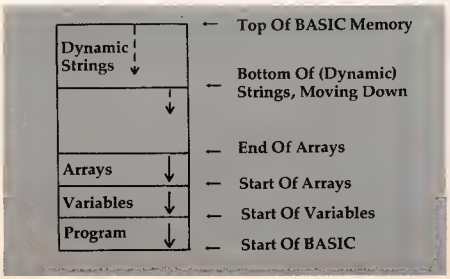
Garbage collection can take up a lot of time; more about this in a moment. Worse, it's hard to predict when it will strike. It's difficult to code in a JUST A MOMENT message when you don't know when that moment will arrive.

You can force a garbage collection by using the FRE(0) function. In order to measure free memory space, the BASIC interpreter must repack the strings. But doing this may not buy you much. You'll find that doing a garbage collection saves you no time on the next one. If the illustrative program above is still in your computer, restore the original line 120 and RUN. When the program is complete—pause and all—type GOTO 140. You'll find that the second collection takes just as long as before, even though we know there's no garbage to be collected.

You may estimate garbage collection timing by using this crude rule of thumb:

G.C. Time = (Number of dimensioned strings) times (Number of dynamic strings) divided by ten;
Answer is in milliseconds.

Caution: This is a very crude formula. The actual time varies from machine to machine and is also dependent on average string length. If we work out this formula in terms of the example, we'll get 800 times 800 divided by 10, giving 64,000 milliseconds or slightly over a minute. Don't worry if your machine gave you a noticeably different time. It's the principle that counts here; and anything over a few seconds is too long. We must learn how to reduce this time drastically.



Causes Of Garbage Collection

All we need to do is learn not to leave waste strings lying around; no waste space, no need for garbage collection. That's easy for me to say, but it will take another article to go into the details of how to do it.

The following rules hint at the details that I'll give in the second part of this article:

1. Don't move strings around. It's tempting to move strings when your program is doing a sorting job. Don't do it; instead of moving strings, move an "index" array.

2. If you transfer strings into and out of computer memory in "blocks," set the unused strings to "null"; for example, A$(X) = "". When your strings are at a minimum—just before reading in the next block—force a quick collection with FRE(0).

3. Identify the garbage-making areas of your program. The most common is a GET or GET# loop which builds longer strings through concatenation. By fiddling with pointers immediately before and after such operations, you can perform a "local" garbage cleanup with great savings of time.

4. Some arrays may be changed to numeric instead of string—for example, "April 6, 1984" may be stored as numeric 19840406. Reducing strings reduces garbage collection time.

5. If all else fails: When garbage collection seems imminent, write all strings to disk and clear them from memory; force a quick collection; read all the strings back in.

Details on all this next time.

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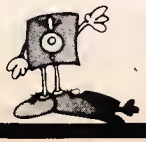

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Programming 64 Sound
Part 1

John Michael Lane

This in-depth look at sound for the 64 provides you with practical methods for controlling the 64's SID chip from BASIC. This two-part article starts off with a brief discussion of sound and music in general.

Sight and sound are two essential components of successful computer games. Though the methods used to produce visual images differ from one computer to another, it is not too hard to produce an image that looks something like what you want. When designing space games, it's really easy, because just about anything can look like a spaceship.

Producing sound, however, can be quite a different matter. How can you produce the sound of a laser gun when dealing with such unfamiliar concepts as frequency, waveforms, and envelopes? (Actually lasers don't make any noise, but you know the sound I mean.)

Without a pretty expensive test setup, it can seem impossible to produce exactly the sound you're looking for. The only recourse is trial and error. Still, if you understand a little about the physics of sound and how it relates to the sound generator you're using, you can produce creditable results.

Real Sound

Sound is produced when physical objects vibrate. Vibrations are then set in motion in the air and travel through the air as sound waves to our ears. Sound, in its purest form, has only two physical attributes, *frequency* and *amplitude*. Frequency, the number of vibrations per second, is usually measured in cycles per second, or *hertz*. The higher the frequency or *pitch* of the sound, the higher a note sounds to our ears.

We've probably never heard a tone that consisted purely of one frequency. Physical objects also create vibrations at frequencies which are multiples of a fundamental frequency. The presence and quantity of these overtones determine the tonal quality, the *color* or *timbre*, of the sound. It's this tonal quality that determines whether a noise we hear sounds like a banjo or a drum (although there are other factors which we'll get to in a minute).

Different instruments and objects produce these overtones in varying amounts. Some produce strong overtones which are even multiples of the fundamental frequency. Some produce tones which are rich in the odd multiples. There really is no limit to the variety of tonal qualities that exist in the real world.

On some organs, and on some music synthesizers, you can specify the exact amount of each overtone you want included in each sound. On the synthesizer included in the Commodore 64, this is handled through the different types of waveforms that can be selected. But how does a waveform relate to tonal quality?

Waveforms

Figure 1 shows a sine wave at the fundamental frequency (all pure tones are sine waves) and at the first overtone or second harmonic. Notice that when we add the two waveforms together, the result no longer exactly resembles a sine wave. In Figure 2 we have continued adding sine waves of

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Figure 1:
Fundamental And Sound Harmonics Combined

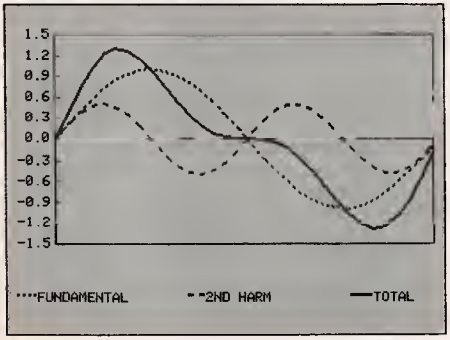
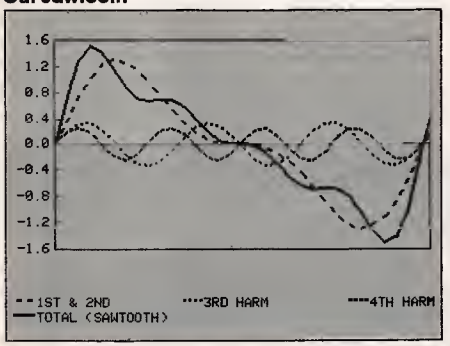


Figure 2:
Adding Third And Fourth Harmonics Brings Out Sawtooth



higher harmonics. You can see now that the resulting total waveshape is beginning to resemble a sawtooth, one of the waveforms available from the Commodore 64's Sound Interface Device (SID). If we kept adding the higher harmonics until we reached infinity, we would have a perfect sawtooth.

So the shape of the wave actually defines the harmonic content of the sound. Since all pure tones are sine waves, the shape of the wave generated by a sound synthesizer is actually assembled from sine waves that are multiples of the fundamental frequency.

The Commodore 64's SID has a choice of three basic waveforms and *white noise*, which is a collection of random frequencies. The three waveforms are a triangular wave, a rectangular pulse wave, and a sawtooth wave. The rectangular pulse wave also has a variable pulse width or *duty cycle*, which allows you additional freedom to vary the color of the sound produced. None of these waveshapes corresponds exactly to the sound produced by any instrument. It is also impossible to duplicate the complex harmonics of a real instrument simply by choosing one of these three waveforms. They do, nevertheless, give you the flexibility to produce a wide variety of color content, and you can get close to the particular sound you're seeking.

The harmonic content of the triangular wave diminishes very quickly, and the color of the wave consists almost entirely of the fundamental frequency. The sawtooth wave is the richest in terms of harmonics and the square wave falls in between. However, since the pulse width of the pulse wave can be varied, it can also contain a great variety of harmonic content.

Sound Envelopes

Earlier we said that sound consists of two qualities, frequency and amplitude. We've discussed primary frequency and how harmonic overtones are defined by the shape of the wave, but what about amplitude or loudness?

We don't mean how loud the sound is simply in the sense of volume, but rather how quickly the sound rises to its full strength and how quickly it dies down again to silence.

If you play an organ, you know that the sound of a note almost immediately reaches its full strength after you press the key and just as quickly dies down when you release the key. To our ears, it's just about instantaneous.

This is quite different from plucking a guitar string, where the sound quickly (but not quite instantaneously) reaches its full height and then slowly dies down, so that the tone continues several seconds after the note was struck. Violins, xylophones, banjos, and woodwinds all are different in the way that the sound rises, is sustained, and then dies down. Generally, these qualities are referred to as the *envelope* of the sound.

Figure 3: Waveform Shapes

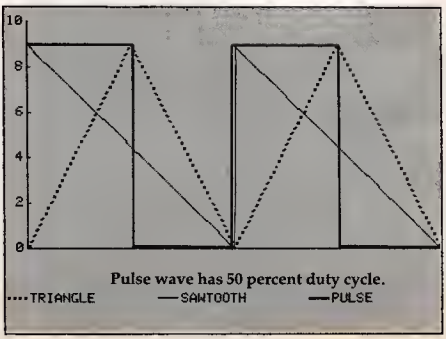
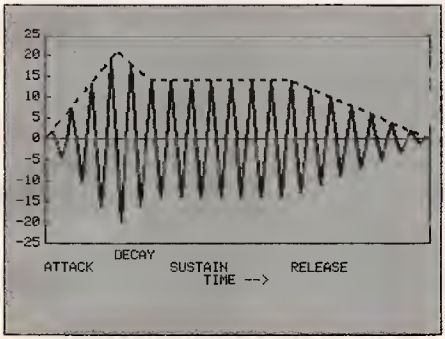


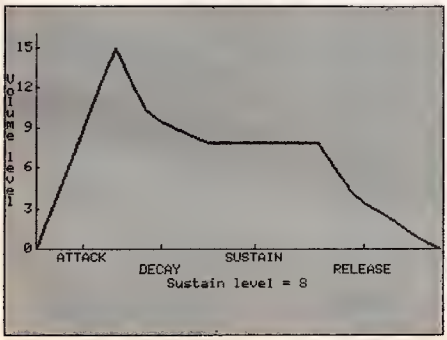
Figure 4:
The Envelope Defines The Height Of Individual Waveforms



If you look at Figure 4, you will see how a sound looks if you could feed it into an oscilloscope. We can see the shape of the wave. The shape of the envelope defines the characteristics of a sound in a manner very similar to the way that harmonic content defines a sound.

The Commodore 64 uses a four-part sound envelope (see Figure 5). The first phase, called the attack, is the length of time it takes for the sound to reach its full volume. The second phase is the decay. During this phase, the sound decreases from the peak achieved during the attack phase to the level set for the sustain phase. During the third or sustain phase, the volume remains constant. In the final phase, the release, the volume decreases to zero.

Figure 5:
Attack/Decay/Sustain/Release Envelope



Not all sounds have this four-part volume envelope. Some have only an attack and release phase, and some (like the organ) have only the sustain phase. We can achieve all these on the Commodore 64 simply by setting the other phases to zero.

Table 1: ADSR Envelope Values

VALUE	ATTACK RATE	DECAY RATE	RELEASE RATE
0	2 ms	6 ms	6 ms
1	8 ms	24 ms	24 ms
2	16 ms	48 ms	48 ms
3	24 ms	72 ms	72 ms
4	38 ms	114 ms	114 ms
5	56 ms	168 ms	168 ms
6	68 ms	204 ms	204 ms
7	80 ms	240 ms	240 ms
8	100 ms	.3 sec	.3 sec
9	.25 sec	.75 sec	.75 sec
10	.5 sec	1.5 sec	1.5 sec
11	.8 sec	2.4 sec	2.4 sec
12	1 sec	3 sec	3 sec
13	3 sec	9 sec	9 sec
14	5 sec	15 sec	15 sec
15	8 sec	24 sec	24 sec

The Commodore's SID allows us to set the attack, decay, and release phases to any one of 15 values or to zero. The times that correspond to the 15 values can be seen in Table 1. The times vary from milliseconds to seconds. Please note that the table does not include times for the sustain phase. The SID allows you to set a sustain volume level, but you must control the length of the sustain by opening and closing a *gate*. That gate is bit 0 of the fourth register in the SID chip. We'll cover this in greater detail later.

To turn the sound *on* in the SID chip, you must open the *gate*. As soon as the gate is opened, the sound level begins to rise at a rate determined by the attack. Once the peak level is reached, the sound begins to decline to the level set for the sustain. The rate at which it declines is defined by the decay.

However, if the sustain level is set at 15 (the highest choice), the decay phase is essentially meaningless because the sustain level and the peak of the attack phase are the same. Thus the decay phase has nowhere to decay to.

Once the decay phase is complete, the sustain cycle will continue as long as the gate is open. Once the gate is closed, the release phase begins and the volume falls from the level set for the sustain phase to zero. So, how long is the sustain phase?

Obviously, the sustain phase lasts as long as the time that the gate is open minus the time required for the attack and decay phases. If you close the gate too soon, you may have no sustain phase at all. If you close it really early, you'll cut short your decay or attack and decay phases as

Figure 6: Standard Four-Part Envelope

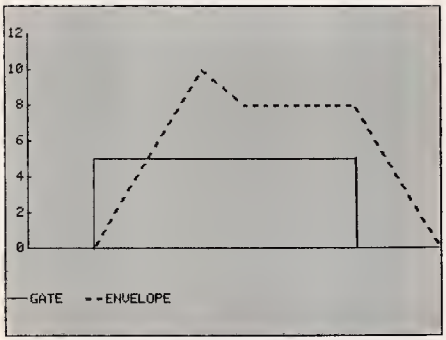


Figure 6a: Organ-like Envelope

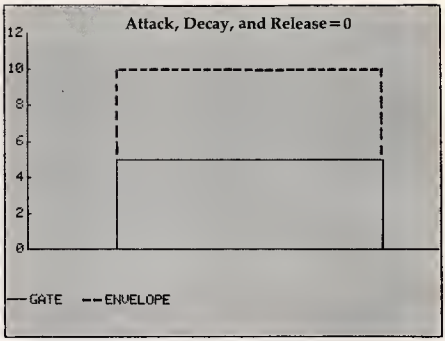


Figure 6b: Piano-like Envelope

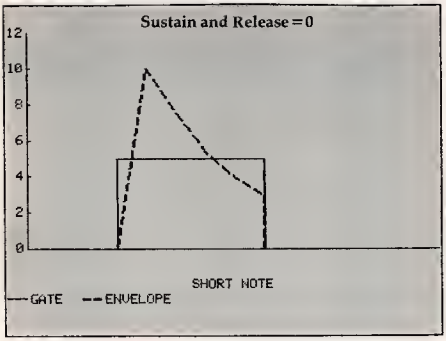
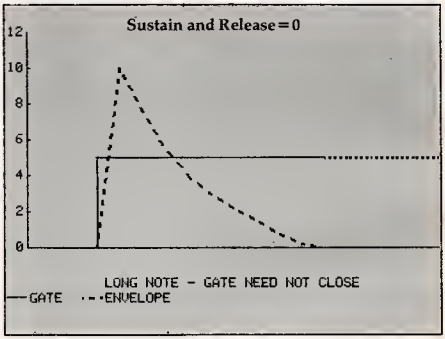


Figure 6c: Piano-like Envelope



well. Figure 6 shows several combinations of attack, decay, and release values and how they interact with the gate to produce the sound envelope.

Programming Sound

The SID is really a quite amazing chip. It takes just 29 registers in your computer's memory, and with those 29 registers (actually you won't even use them all) you can produce a great variety of sounds. We'll call them *registers*, but they're actually a row of 29 bytes of memory.

For our purposes, we'll consider only the first 21 registers in the SID chip. We'll also briefly consider the twenty-fifth register, which sets the volume (no volume, no sound).

The first 21 registers break down into three groups of seven. That's because the SID has three voices, and the seven register groups perform almost the same function for all three voices. That makes it far easier—all we have to learn is how to program seven registers.

Table 2 gives the functions of the seven register groups. Registers 0 and 1 hold the frequency. Register 0 contains the least significant byte, and register 1 the most significant byte. With two registers you can record only numbers less than 65512. That sounds pretty high, but the frequency contained in the two registers relates to the internal oscillator (clock) of the Commodore 64 and does not translate to the frequency we are familiar with in terms of cycles per second (hertz). To translate into hertz, you must multiply the frequency contained in the two registers by .059605. This means that the highest frequency the SID can produce is 3904 hertz. The frequency can go as low as zero, but the sound system in your TV set probably won't reproduce a frequency of less than 50 hertz (or 840 to the SID).

The easy way to load the frequency into the two registers is to use this program segment:

```
100 S=54272 :REM (STARTING ADDRESS OF SID
    CHIP)
110 F0=FR/.059605:REM FR=FREQUENCY IN CYC
    LES/SECOND
120 F2=INT(F0/256):F1=F0-256*F2
130 POKE S,F1:POKE S+1,F2
```

If you already know the frequency in terms

Table 2:
Map Of Sound Interface Device (SID) Registers

```
ADDRESS  REG #   BIT 7   BIT 6   BIT 5   BIT 4   BIT 3   BIT 2   BIT 1   BIT 0
=================================================================================
                          VOICE ONE
FREQUENCY REGISTERS
54272    0       [<------        FREQUENCY     LOW ORDER BYTE          ------>]
54273    1       [<------      FREQUENCY     HIGH ORDER BYTE           ------>]
PULSE WIDTH REGISTERS
54274    2       [<------      PULSE WIDTH     LOW ORDER BYTE          ------>]
54275    3       [<------BITS 7-4 NOT USED---->][ HIGHEST 4 BITS OF PULSE WIDTH]
CONTROL REGISTER
54276    4       [NOISE][PULSE ][SAWTH.][TRIANG][ TEST ][ RING ][ SYNC ][ GATE ]
ATTACK/DECAY REGISTER
54277    5       [<----   ATTACK VALUE    ---->][<---     DECAY VALUE      --->]
SUSTAIN/RELEASE REGISTER
54278    6       [<----   SUSTAIN LEVEL   ---->][<---    RELEASE VALUE     --->]

                          VOICE TWO
FREQUENCY REGISTERS
54279    7       [<------        FREQUENCY     LOW ORDER BYTE          ------>]
54280    8       [<------      FREQUENCY     HIGH ORDER BYTE           ------>]
PULSE WIDTH REGISTERS
54281    9       [<------      PULSE WIDTH     LOW ORDER BYTE          ------>]
54282    10      [<------BITS 7-4 NOT USED---->][ HIGHEST 4 BITS OF PULSE WIDTH]
CONTROL REGISTER
54283    11      [NOISE][PULSE ][SAWTH.][TRIANG][ TEST ][ RING ][ SYNC ][ GATE ]
ATTACK/DECAY REGISTER
54284    12      [<----   ATTACK VALUE    ---->][<---     DECAY VALUE      --->]
SUSTAIN/RELEASE REGISTER
54285    13      [<----   SUSTAIN LEVEL   ---->][<---    RELEASE VALUE     --->]

                          VOICE THREE
FREQUENCY REGISTERS
54286    14      [<------        FREQUENCY     LOW ORDER BYTE          ------>]
54287    15      [<------      FREQUENCY     HIGH ORDER BYTE           ------>]
PULSE WIDTH REGISTERS
54288    16      [<------      PULSE WIDTH     LOW ORDER BYTE          ------>]
54289    17      [<------BITS 7-4 NOT USED---->][ HIGHEST 4 BITS OF PULSE WIDTH]
CONTROL REGISTER
54290    18      [NOISE][PULSE ][SAWTH.][TRIANG][ TEST ][ RING ][ SYNC ][ GATE ]
ATTACK/DECAY REGISTER
54291    19      [<----   ATTACK VALUE    ---->][<---     DECAY VALUE      --->]
SUSTAIN/RELEASE REGISTER
54292    20      [<----   SUSTAIN LEVEL   ---->][<---    RELEASE VALUE     --->]

VOLUME REGISTER
54296    24      [-NOT COVERED IN THIS ARTICLE-][<----  VOLUME CONTROL    ---->]
```

of the SID chip, you can omit line 110.

The next two registers contain the pulse width of the rectangular pulse wave. This value is a 12-bit number with the eight least significant bits stored in register 2, and the four most significant stored in bits 3–0 of register 3. The four remaining bits of register 3 are not used. If you are using something other than a rectangular pulse wave, you don't have to worry about these two registers.

The pulse width can take a value from 0 to 4095, which corresponds to a range of 0 to 100 percent for the duty cycle. A value of 2048 implies a 50 percent duty cycle and generates a square wave. If these two registers are set to zero and the rectangular pulse wave is selected, no sound will be produced.

The following program segment can be used to set the pulse width.

```
140 P0=DC*4095/100:REM DC=DUTY CYCLE IN %
150 P2=INT(P0/256):P1=P0-256*P2
160 POKE S+2,P1:POKE S+3,P2
```

We should add here that a duty cycle of 10 percent will sound exactly the same as a duty cycle of 90 percent. For some advanced applications the two may sound different, but for a solitary rectangular pulse wave voice, there will be no difference.

Next month we'll get into more complicated music programming. ©

Apple Input And Menu Screens

Dan Jordan

The screen formatting and menu display techniques demonstrated here will make your Apple programs easier to use.

Menus and formatted screens are two excellent ways to make programs more user-friendly. The two programs included here are simple examples of these techniques.

The "Menu Screen" routine (Program 1) generates a menu and uses a selection bar to help the user choose program functions. To create the illusion of movement by the selection bar, lines 370–390 blot out the existing bar, and lines 310–340 place a new bar on the next line.

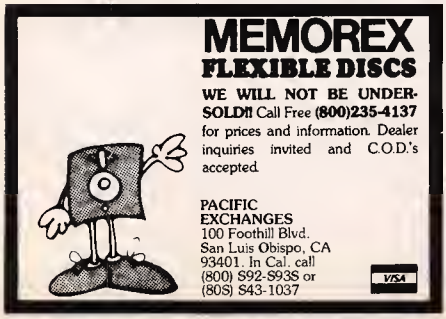
The "Input Screen" routine (Program 2) prints a form on the screen and indicates, by the length of the inverse blank field, the amount of data to be entered. A subroutine can be added to check for field length, if desired. The correction routine (lines 500–570) lets you correct a data section without affecting any other part of the program.

PRINT CHR$(7) rings a bell, prompting the user to answer a question printed on the screen.

Using GET rather than INPUT saves keystrokes in answering these screen prompts (the RETURN key need not be hit to enter data that is input with a GET).

Program 1: Menu Screen Routine

```
170  CLEAR
190  HOME
200  PRINT "********** MENU ************"
210  PRINT "1-STEP NUMBER 1"
220  PRINT "2-STEP NUMBER 2"
230  PRINT "3-STEP NUMBER 3"
240  PRINT "4-STEP NUMBER 4"
250  PRINT "5-STEP NUMBER 5"
260  PRINT "6-STEP NUMBER 6"
270  PRINT : PRINT
2B0  PRINT "HIT (RETURN) TO SELECT --OR
     --"
290  PRINT "HIT ANY OTHER KEY TO CHANGE
      SELECTION"
300 I = 2
310  VTAB I
315  HTAB 17
320  INVERSE
330  PRINT "      ";
340  NORMAL
350  GET X$
360  IF X$ =  CHR$ (13) THEN Y = I - 1:
      GOTO 490
370  VTAB I
3B0  HTAB 17
390  PRINT "      "
400 I = I + 1
410  IF I >  = B THEN I = 2
420  GOTO 310
490  VTAB 14
500  ON Y GOTO 1000,2000,3000,4000,5000
     ,6000
1000  REM STEP NO.1 PROCEDURES
1010  PRINT "STEP NO. 1"
1020  GOTO 7000
2000  REM STEP NO.2 PROCEDURES
2010  PRINT "STEP NO. 2"
2020  GOTO 7000
3000  REM STEP NO.3 PROCEDURES
3010  PRINT "STEP NO. 3"
3020  GOTO 7000
4000  REM STEP NO.4 PROCEDURES
4010  PRINT "STEP NO. 4"
4020  GOTO 7000
5000  REM STEP NO.4 PROCEDURES
5010  PRINT "STEP NO. 5"
5020  GOTO 7000
6000  REM STEP NO.6 PROCEDURES
6010  PRINT "STEP NO. 6"
6020  GOTO 7000
7000  END
```

Program 2: Input Screen Routine

```
180  CLEAR
190  DIM A$(5,100)
200  HOME
210  PRINT "*****NAME & ADDRESS INPUT *
     ****"
220  PRINT "1-NAME----------"
230  PRINT "2-ADDRESS LINE 1"
240  PRINT "3-ADDRESS LINE 2"
250  PRINT "4-CITY STATE ZIP"
260  PRINT "5-TELEPHONE NO.-"
270  FOR I = 2 TO 6
280  VTAB I
290  HTAB 17
300  INVERSE
310  PRINT "                    "
320  NORMAL
330  NEXT I
335 X = 1
340  FOR I = 2 TO 6
345  VTAB I: HTAB 17
350  INPUT A$(I - 1,X)
360  NEXT I
370  PRINT : PRINT  CHR$ (7)
3B0  PRINT "DO YOU WISH TO MAKE A CORRE
     CTION (Y OR N)?";
390  GET X$
400  IF X$ = "Y" THEN  GOTO 500
410  IF X$ = "N" THEN  GOTO 450
420  VTAB 7: GOTO 370
450  PRINT  CHR$ (7);
460  PRINT "DO YOU HAVE ANY MORE TO ENT
     ER (Y OR N)?";
470  GET X$
4B0  IF X$ = "N" THEN  GOTO 1000
4B5  IF X$ = "Y" THEN X = X + 1: GOTO 2
     00
490  VTAB 8: GOTO 450
500  PRINT  CHR$ (7);
510  PRINT "ENTER LINE NUMBER YOU WISH
     TO CORRECT";
520  GET Y
530 Y = Y + 1
540  VTAB Y
550  HTAB 17
560  INPUT A$(Y - 1,X)
570  VTAB 7
580  GOTO 370
1000  REM  PRINT OR SAVE TO DISK
1010  END
```

A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in COMPUTE! are written in a computer language called BASIC. BASIC is easy to learn and is built into most computers (on some computers, you have to purchase an optional BASIC cartridge).

BASIC Programs

Each month, COMPUTE! publishes programs for many machines. To start out, type in only programs written for your machine, e.g., "TI Version" if you have a TI-99/4. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from one computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as O for the numeral 0, a lowercase l for the numeral 1, or an uppercase B for the numeral 8. Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Braces And Special Characters

The exception to this typing rule is when you see the braces, such as {DOWN}. Anything within a set of braces is a special character or characters that cannot easily be listed in a printer. When you come across such a special statement, refer to the appropriate key for your computer. For example, if you have an Atari, refer to the "Atari" section in "How To Type COMPUTE!'s Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard, break key, and RESET (or STOP) keys may all seem "dead," and the screen may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, so always SAVE a copy of your program before you RUN it. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

1. Type in the program a line at a time, in order. Press RETURN or ENTER at the end of each line. Use backspace or the back arrow to correct mistakes.

2. Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.

3. Make sure you've entered statements in braces as the appropriate control key (see "How To Type COMPUTE!'s Programs" elsewhere in the magazine).

We regret that we are no longer able to respond to individual inquiries about programs, products, or services appearing in COMPUTE! *due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear on the CAPUTE! page, usually within eight weeks. If you have specific questions about items or programs which you've seen in* COMPUTE!, *please send them to Readers' Feedback, P.O. Box 5406, Greensboro, NC 27403.* ©

How To Type COMPUTE!'s Programs

Many of the programs which are listed in COMPUTE! contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to tell exactly what to type when entering one of these programs into your computer, we have established the following listing conventions. There is a separate key for each computer. Refer to the appropriate tables when you come across an unusual symbol in a program listing. If you are unsure how to actually enter a control character, consult your computer's manuals.

Atari 400/800

Characters in inverse video will appear like: INVERSE VIDEO
Enter these characters with the Atari logo key, {A}.

When you see	Type	See	
{CLEAR}	ESC SHIFT <		Clear Screen
{UP}	ESC CTRL -		Cursor Up
{DOWN}	ESC CTRL =		Cursor Down
{LEFT}	ESC CTRL +		Cursor Left
{RIGHT}	ESC CTRL *		Cursor Right
{BACK S}	ESC DELETE		Backspace
{DELETE}	ESC CTRL DELETE		Delete character
{INSERT}	ESC CTRL INSERT		Insert character
{DEL LINE}	ESC SHIFT DELETE		Delete line
{INS LINE}	ESC SHIFT INSERT		Insert line
{TAB}	ESC TAB		TAB key
{CLR TAB}	ESC CTRL TAB		Clear tab
{SET TAB}	ESC SHIFT TAB		Set tab stop
{BELL}	ESC CTRL 2		Ring buzzer
{ESC}	ESC ESC		ESCape key

Graphics characters, such as CTRL-T, the ball character ● will appear as the "normal" letter enclosed in braces, e.g. {T}.

A series of identical control characters, such as 10 spaces, three cursor-lefts, or 20 CTRL-R's, will appear as {10 SPACES}, {3 LEFT}, {20 R}, etc. If the character in braces is in inverse video, that character or characters should be entered with the Atari logo key. For example, {■} means to enter a reverse-field heart with CTRL-comma, {5■} means to enter five inverse-video CTRL-U's.

Commodore PET/CBM/VIC/64

Generally, any PET/CBM/VIC/64 program listings will contain words within braces which spell out any special characters: {DOWN} would mean to press the cursor down key. {5 SPACES} would mean to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listings. For example, S would mean to type the S key while holding the shift key. If you find an underlined key enclosed in braces (e.g., {10 N}), you should type the key as many times as indicated (in our example, you would enter ten shifted N's). Some graphics characters are inaccessible from the keyboard on CBM Business models (32N, 8032).

For the VIC and 64, if a key is enclosed in special brackets, [< >], you should hold down the *Commodore key* while pressing the key inside the special brackets. (The Commodore key is the key in the lower left corner of the keyboard.) Again, if the key is preceded by a number, you should press the key as many times as indicated.

Rarely, you'll see in a Commodore 64 program a solitary letter of the alphabet enclosed in braces. These characters can be entered by holding down the CTRL key while typing the letter in the braces. For example, {A} would indicate that you should press CTRL-A.

About the *quote mode*: you know that you can move the cursor around the screen with the CRSR keys. Sometimes a programmer will want to move the cursor under program control. That's why you see all the {LEFT}'s, {HOME}'s, and {BLU}'s in our programs. The only way the computer can tell the difference between direct and programmed cursor control is the quote mode.

Once you press the quote (the double quote, SHIFT-2), you are in the quote mode. If you type something and then try to change it by moving the cursor left, you'll only get a bunch of reverse-video lines. These are the symbols for cursor left. The only editing key that isn't programmable is the DEL key; you can still use DEL to back up and edit the line. Once you type another quote, you are out of quote mode.

You also go into quote mode when you INSerT spaces into a line. In any case, the easiest way to get out of quote mode is to just press RETURN. You'll then be out of quote mode and you can cursor up to the mistyped line and fix it.

Use the following tables when entering special characters:

VIC And 64

When You Read:	Press:		See:
{CLR}	SHIFT	CLR/HOME	
{HOME}		CLR/HOME	
{UP}	SHIFT	CRSR ↑	
{DOWN}		CRSR ↓	
{LEFT}	SHIFT	CRSR ←	
{RIGHT}		CRSR →	
{RVS}	CTRL	9	
{OFF}	CTRL	0	
{BLK}	CTRL	1	
{WHT}	CTRL	2	
{RED}	CTRL	3	
{CYN}	CTRL	4	
{PUR}	CTRL	5	

When You Read:	Press:		See:
{GRN}	CTRL	6	
{BLU}	CTRL	7	
{YEL}	CTRL	8	
{F1}	f1		
{F2}	f2		
{F3}	f3		
{F4}	f4		
{F5}	f5		
{F6}	f6		
{F7}	f7		
{F8}	f8		
←	←		
↑	SHIFT	↑	

All Commodore Machines

Clear Screen	{CLR}	Cursor Left	{LEFT}
Home Cursor	{HOME}	Insert Character	{INST}
Cursor Up	{UP}	Delete Character	{DEL}
Cursor Down	{DOWN}	Reverse Field On	{RVS}
Cursor Right	{RIGHT}	Reverse Field Off	{OFF}

Apple II / Apple II Plus

All programs are in Applesoft BASIC, unless otherwise stated. Control characters are printed as the "normal" character enclosed in braces, such as {D} for CTRL-D. Hold down CTRL while pressing the control key. You will not see the special character on the screen.

Texas Instruments 99/4

The only special characters used are in PRINT statements to indicate where two or more spaces should be left between words. For example, ENERGY {10 SPACES} MANAGEMENT means that ten spaces should be left between the words ENERGY and MANAGEMENT. Do not type in the braces or the words 10 SPACES. Enter all programs with the ALPHA LOCK on (in the down position). Release the ALPHA LOCK to enter lowercase text.

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CAPUTE!

Modifications Or Corrections To Previous Articles

VIC Worm Of Bemer

The listing for the VIC version of this game from the April issue (p. 74) contains Commodore 64 color codes which are not available on the VIC. These cause no serious problems, but the [6] or [8] character should be omitted in lines 7715, 7730, and 10000.

Super Directory For 64 And IBM

Commodore 64 users have found that using "Super Directory" (Program 1, p. 173) from the April issue to load and run programs can cause problems if the program selected uses the BASIC function RND. An overflow error will be encountered because Super Directory alters a memory location used in calculating random numbers. Brian T. Bennett has discovered that the problem can be solved by changing line 1150 to:

```
1150 POKE 139,128:GOTO 5000
```

The IBM version (Program 4, p. 176) cannot be used to load and run programs from a disk with the write-protect notch covered. This is due to the way DOS handles the Write-Protect Error. Note also that the program as presented will work only with DOS 2.0 or 2.1.

TI Mozart Machine

Music aficionados may have detected a sour note in the tunes played by the TI version of this program from the January issue (Program 4, p. 168). The solution is to change the next to the last DATA element in line 480 from 287 to 587. Thanks to Kevin M. Norberg for this correction.

Atari Roader Improvements

Mike La Fave offers the following revision to this game from the March issue (Program 3, p. 70) to allow you to steer your racer with a joystick instead of the keyboard:

```
220 P=STICK(0):IF P=11 THEN N=N-1:GOTO
    240
230 IF P=7 THEN N=N+1
```

Also, Keith Christleib suggests the following additions to include an engine sound as the car speeds down the track:

```
201 SOUND 3,135,2,9
315 SOUND 3,0,0,0
```

64Key Relocated

Reader Mike Levesque notes that the "64Key" program from the February issue (p. 160) uses the same area of memory as the DOS Wedge program supplied with the 1541 demo disk. To use these two valuable utilities together, he suggests changing the following lines:

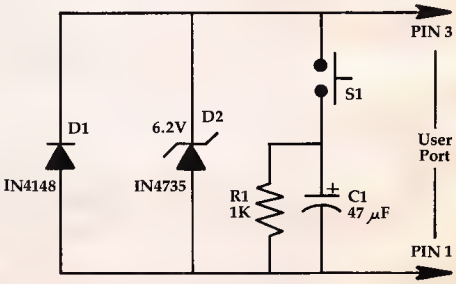
```
20 FOR I=51789 TO 51967
50 IF X<>23734 THEN PRINT "THERE IS AN
   ERROR IN YOUR DATA STATEMENTS":END
60 PRINT"SYS 51789 TO ACTIVATE":END
```

Next, change the DATA element 205 to 202 in the following lines: 100, 120, 130, 140, 150, 190, 220, 300, and 320. Finally, remove the ,0 from the end of line 430 and delete line 440. These changes relocate 64Key to the area immediately above the Wedge, allowing the two to coexist in harmony and still leaving locations 49152–51788 free for other uses.

64 Explorer RESET Switch

Columnist Larry Isaacs recommends a revision of RESET switch circuit for the 64 featured in his March column (p. 172). Larry based his design on the schematic diagram of the 64 included in the *Programmer's Reference Guide*. However, the actual circuitry in the 64 has since been slightly modified and, as a result, it is no longer safe to ground the RESET line directly. Although Larry has used his switch for several months without incident, it presents some risk of damaging the chips inside the computer, and you should consider this before attempting to use the switch on your computer.

As an alternative, Lester Iwamasa of Custom Concepts, who pointed out the danger of using the original circuit, has provided the following circuit which performs a RESET without the possibility of damage to the computer:



64 RESET SWITCH

If you're not up to building this circuit yourself, you can obtain it for $21.95, plus $2.00 shipping, from:

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The Automatic Proofreader
For VIC, 64, And Atari

Charles Brannon, Program Editor

At last there's a way for your computer to help you check your typing. "The Automatic Proofreader" will make entering programs faster, easier, and more accurate.

The strong point of computers is that they excel at tedious, exacting tasks. So why not get your computer to check your typing for you?

With "The Automatic Proofreader" nestled in your VIC-20, Commodore 64, or Atari computer, every line you type in will be verified. It displays a special code, called a *checksum*, at the top of the screen. The checksum, either a number (VIC/64) or a pair of letters (Atari), corresponds to the line you've just typed. It represents every character in the line summed together. A matching code in the program listing lets you compare it to the checksum which the Proofreader displays. A glance is all it takes to confirm that you've typed the line correctly.

Entering The Automatic Proofreader

Commodore (VIC/64) owners should type in Program 1. Program 2 is for Atari users. Since the Proofreader is a machine language program, be especially diligent. Watch out for typing extra commas, or a letter O for a zero, and check every number carefully. If you make a mistake when typing in the DATA statements, you'll get the message "Error in DATA statements" when you RUN the program. Check your typing and try again.

When you've typed in The Automatic Proofreader, SAVE it to tape or disk at least twice *before running it for the first time*. If you mistype the Proofreader, it may cause a system crash when you first run it. By SAVEing a copy beforehand, you can reLOAD it and hunt for your error. Also, you'll want a backup copy of the Proofreader because you'll use it again and again—every time you enter a program from COMPUTE!.

When you RUN the Proofreader, the program will be POKEd safely into memory, then it will activate itself. If you ever need to reactivate it (RUN/STOP—RESTORE or SYSTEM RESET will disable it), just enter the command SYS 886 (VIC/64) or PRINT USR(1536) for the Atari.

Using The Proofreader

Now, let's see how it works. LIST the Proofreader program, move the cursor up to one of the lines, and press RETURN. If you've entered the Proofreader correctly, a checksum will appear in the top-left corner of your screen.

Try making a change in the line and hit RETURN. Notice that the checksum has changed. All VIC and 64 listings in COMPUTE! now have a number appended to the end of each line, for example, :rem 123. *Don't enter this statement.* It is just for your information. The rem is used to make the number harmless if someone does type it in. It will, however, use up memory if you enter it, and it will cause the checksum displayed at the top of the screen to be different, even if you entered the rest of the line correctly.

The Atari checksum is found immediately to the left of each line number. This makes it impossible to type in the checksum accidentally, since a program line must start with a number.

Just type in each line (without the printed checksum), and check the checksum displayed at the top of the screen against the checksum in the listing. If they match, go on to the next line. If they don't, there's a mistake. You can correct the line immediately, instead of waiting to find the error when you RUN the program.

The Proofreader is not picky with spaces. It will not notice extra spaces or missing ones. This is for your convenience, since spacing is generally not important. Occasionally proper spacing is important, but the article describing the program will warn you to be careful in these cases.

Nobody's Perfect

Although the Proofreader is an important aid, there are a few things to watch out for. If you enter a line by using abbreviations for commands, the checksum will not match up. This is because the Proofreader is very literal: It looks at the individual letters in a line, not at tokens such as PRINT. There is a way to make the Proofreader check such a line. After entering the line, LIST it. This makes the computer spell out the abbreviations. Then move the cursor up to the line and press RETURN. It should now match the checksum. You can check whole groups of lines this way. Atari users should beware of using ? as an abbreviation for PRINT—they're not the same thing in the Proofreader's eyes.

The checksum is a sum of the ASCII values of the characters in a line. VIC and 64 owners may wonder why the numbers are so small, never exceeding 255. This is because the addition is done only in eight bits. A result over 255 will roll over past zero, like an odometer past 99999. On the Atari, the number is turned into two letters, both for increased convenience and to make the Proofreader shorter. For the curious, the letters correspond to the values of the left and right nybbles added to 33 (to offset them into the alphabet). This number is then stored directly into screen memory.

Due to the nature of a checksum, the Proofreader will not catch all errors. Since 1+3+5=3+1+5, the Proofreader cannot catch errors of transposition. In fact, you could type in the line in any order, and the Proofreader wouldn't notice. Anytime the Proofreader

seems to act strange, keep this in mind. Since the ASCII values of the number 18 (49+56) and 63 (54+51) both equal 105, these numbers are equal according to the Proofreader. There really is no simple way to catch these kinds of errors. Fortunately, the Proofreader will catch the majority of the typing mistakes most people make.

If you want the Proofreader out of your way, just press SYSTEM RESET or RUN/STOP—RESTORE. If you need it again, enter SYS 828 (VIC/64) or PRINT USR(1536) (Atari). You must disable the Proofreader before doing any tape operations on the VIC or 64.

Hidden Perils

The Proofreader's home in the VIC and 64 is not a very safe haven. Since the cassette buffer is wiped out during tape operations, you need to disable the Proofreader with RUN/STOP—RESTORE before you SAVE your program. This applies only to tape use. Disk users or Atari owners have nothing to worry about.

Not so for VIC and 64 owners with tape drives. What if you type in a program in several sittings? The next day, you come to your computer, LOAD and RUN the Proofreader, then try to LOAD the partially completed program so you can add to it. But since the Proofreader is trying to hide in the cassette buffer, it is wiped out!

What you need is a way to LOAD the Proofreader after you've LOADed the partial program. The problem is, a tape load to the buffer destroys what it's supposed to load.

After you've typed in and RUN the Proofreader, enter the following lines in direct mode (without line numbers) *exactly* as shown:

```
A$="PROOFREADER.T": B$="{10 SPACES}": FOR
   X = 1 TO 4: A$=A$+B$: NEXTX

FOR X = 886 TO 1018: A$=A$+CHR$(PEEK(X)):
   NEXTX

OPEN 1,1,1,A$:CLOSE1
```

After you enter the last line, you will be asked to press record and play on your cassette recorder. Put this program at the beginning of a new tape. This gives you a new way to load the Proofreader. Anytime you want to bring the Proofreader into memory without disturbing anything else, put the cassette in the tape drive, rewind, and enter:

```
OPEN1:CLOSE1
```

You can now start the Proofreader by typing SYS 886. To test this, PRINT PEEK(886) should return the number 173. If it does not, repeat the steps above, making sure that A$ ("PROOFREADER.T") contains 13 characters and that B$ contains 10 spaces.

You can now reload the Proofreader into memory whenever LOAD or SAVE destroys it, restoring your personal typing helper.

Incidentally, you can protect the cassette buffer on the Commodore 64 with POKE 178,165. This POKE should work on the VIC, but it has caused numerous problems, probably due to a bug in the VIC operating system. With this POKE, the 64 will not wipe out the cassette buffer during tape LOADs and SAVEs.

Program 1: VIC/64 Proofreader

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO
    1018:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MAD
    E AN ERROR":PRINT"IN DATA STATEMENTS.
    ":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER
     ACTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

Program 2: Atari Proofreader

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:READ A:POKE I
    ,A:CK=CK+A:NEXT I
120 IF CK<>19072 THEN ? "Error in DA
    TA statements. Check typing":END

130 A=USR(1536)
140 ? :? "Automatic Proofreader now
    activated."
150 END
1536 DATA 104,160,0,185,26,3
1542 DATA 201,69,240,7,200,200
1548 DATA 192,34,208,243,96,200
1554 DATA 169,74,153,26,3,200
1560 DATA 169,6,153,26,3,162
1566 DATA 0,189,0,228,157,74
1572 DATA 6,232,224,16,208,245
1578 DATA 169,93,141,78,6,169
1584 DATA 6,141,79,6,24,173
1590 DATA 4,228,105,1,141,95
1596 DATA 6,173,5,228,105,0
1602 DATA 141,96,6,169,0,133
1608 DATA 203,96,247,238,125,241
1614 DATA 93,6,244,241,115,241
1620 DATA 124,241,76,205,238,0
1626 DATA 0,0,0,0,32,62
1632 DATA 246,8,201,155,240,13
1638 DATA 201,32,240,7,72,24
1644 DATA 101,203,133,203,104,40
1650 DATA 96,72,152,72,138,72
1656 DATA 160,0,169,128,145,88
1662 DATA 200,192,40,208,249,165
1668 DATA 203,74,74,74,74,24
1674 DATA 105,161,160,3,145,88
1680 DATA 165,203,41,15,24,105
1686 DATA 161,200,145,88,169,0
1692 DATA 133,203,104,170,104,168
1698 DATA 104,40,96
```

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NEWS & PRODUCTS

64 Data Base

ABS Software has announced *Compufile*, a relative data base for the Commodore 64.

Compufile has 20 user-defined fields, user-defined reports, multiple levels of search and sort abilities, and a user-changeable format. Multiple data bases can be stored on a single disk. The system will automatically correct many error conditions, and can deliver records in sequential file form so they can be accessed by word processors.

The program is menu-driven, and runs in machine language. A directory of all data bases contained on a disk is automatically displayed on the screen at the start. More than 50 pages of documentation are available, and templates are included to aid in creating general interest data bases.

Compufile sells for $39.95 on disk.

ABS(olute) Software
1780 Austin Highway
San Antonio, TX 78218
(512) 826-9698

Apple Time Management System

Creative Peripherals Unlimited, Inc., has announced *Time-Trax, The Time Management System* for the Apple II, II+, and IIe computers.

The system is a time- and date-oriented appointment and scheduling program which plugs into the computer's game port and provides another port for game paddles. It is powered by the computer when turned on and by two AA batteries (not included) when the computer is off.

Up to 311 entries can be made in a single month, and up to 99 entries can be included on a single day. Important entries can be flagged. Annual entries can be made that will appear every year on the scheduled day and time, such as birthdays, policy renewals, and anniversaries. The program has search features, and will allow printouts of information.

Time-Trax is available for $99.95.

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(800) 432-7268 California

Atari Keyboard Graphics Labels

Graph-Fix, a set of 29 graphics labels for Atari keyboards, is available from Dovestar Creative Concepts.

The Mylar-coated labels are applied to the front face of each graphics key and fit all Atari models. They are intended to

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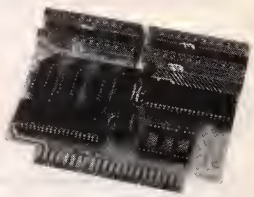

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Versatile Print Package For Apple

Brøderbund Software has introduced *The Print Shop*, a disk-based software package that enables you to write, design, and print greeting cards, stationery, letterheads, signs, and even banners.

The menu-driven program requires an Apple II+ or Apple IIe with at least 48K memory. *The Print Shop* supports many popular printers, including the Epson, Apple Dot Matrix, Imagewriter, and C. Itoh Prowriter.

Messages can be written in one of eight different type styles available in two sizes, and in solid, outline, and three-dimensional formats. There are nine border designs, ten abstract patterns, and dozens of pictures and symbols to use.

There is a built-in graphics editor with which you can create your own designs. With only one pass through a printer, *The Print Shop* will produce a greeting card with inside and outside messages. The program will let you print out your writing with proportional spacing. Custom letterheads with personalized logos, full-page signs with graphics, banners of unlimited length with extra-large letters—all are available with the package.

The Print Shop comes with an assortment of pin-feed paper and matching envelopes in various colors, and has a suggested retail price of $49.95. Paper refills are available for $14.95.

Brøderbund Software
17 Paul Drive
San Rafael, CA 94903
(415) 479-1170

Software Buyers' Guide

The fourth edition of the *Software Express*, a 320-page guide with more than 800 programs for Apple, Atari, Commodore 64, VIC-20, and IBM PC and PCjr computers, is available from SKU, Inc.

The guide includes listings and descriptions of the best-selling and highest-rated software. The new edition has a section on computer peripherals and accessories, a glossary of 100 computer and data processing terms, manufacturer coupons worth $100 in discounts, and six tutorial articles on what to look for when buying software.

Software Express, published quarterly, is available for $9.95 per copy and on a subscription basis for $18.95 a year.

SKU, Inc.
2600 Tenth Street
Berkeley, CA 94710
(415) 848-0802

Educational Software For Atari, Commodore

Gladstone Electronics, Inc., has released "*Diskovery*" *Reading Words*, four software packages designed to help children increase their learning rate and improve school work, and two programs that help develop math skills.

The Alphabet Factory and *Match-Up* are designed for children from three to eight years old. *The Word Bird* and *Time Zone* are offered for children from six to twelve years old. The series of programs uses animated graphics, color, and sound to help motivate students in learning to read. An arcade-game format is used in each.

Adding Machine and *Take-Away Zoo* are the two math skill development packages.

Each of the programs is available on disk for $29.95 for Com-

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TI-99/4A Cartridge Expander

Navarone Industries produces the Cartridge Expander, which plugs into the game port of the TI-99/4A and allows up to three cartridges to be plugged in at one time.

The expander also contains a built-in reset button and a select switch that lets you change from one cartridge to another without plugging and unplugging cartridges.

The Cartridge Expander is available for $39.95.

Navarone Industries
510 Lawrence Expressway #800
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(408) 866-8579

PCjr, Atari Audio Tutorials

Tutorials for new owners of PCjr and Atari 600XL and 800XL computers are available on audio cassette from FlipTrack Learning Systems.

How To Operate the IBM PCjr has two audio cassettes. The first cassette guides the user through start-up procedures; keyboard familiarization; simple BASIC programming; and the PCjr's color, sound, graphics, and mathematical capabilities, as well as cassette tape storage and use of a printer.

The second cassette includes information on how to manage disk storage and files with DOS. The lesson covers directory display, using tree-structured directories, checking disk storage space, and copying the formatting disks, as well as copying, renaming, and erasing files, and batch processing.

How To Operate the Atari 600XL and 800XL Home Computer is a tutorial on one audio cassette and one data cassette. The package teaches start-up procedures, keyboard familiarization, and how to take advantage of the Atari's color, sound, graphics, and mathematical capabilities. Step-by-step BASIC programming is also taught.

The tutorials use the FlipTrack cassette format, which permits the user to branch into optional special interest areas with the flip of a cassette.

The PCjr tutorial sells for $39.95, and the Atari tutorial is available for $19.95. They operate on standard cassette players.

FlipTrack Learning Systems
999 Main
Suite 200
Glen Ellyn, IL 60137
(312) 790-1117

Four Educational Games For 64, Atari

Spinnaker Software has four new educational software titles, two for the Commodore 64, one for the Atari, and one for both computers.

Grandma's House, directed toward children four to eight, is a game for the 64 and the Atari that lets youngsters create and furnish their own playhouse. The program helps children learn to design and create, and is available on disk for $34.95.

Ranch, ages five to ten, is available on cartridge for the 64. The program lets a player create and animate wild west scenes. Starting with a blank screen, the player populates it with a range of people, objects, and animals. You can copy, color, move, erase, or animate shapes. *Ranch* is

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Aegean Voyage, for ages eight to adult, has players navigate ships through the Aegean Sea, docking at islands to collect clues from the Oracles. By connecting the clues, players can find treasure. The game introduces many names from Greek mythology and emphasizes strategic thinking and deductive reasoning. The program is available for $39.95 on cartridge.

Adventure Creator, ages 12 to adult, lets players learn how to design an adventure game. Players have up to 100 rooms to fill with mazes, creatures, hazards, and treasures. The program also can have the computer design the world for the player. *Adventure Creator* is available on cartridge for the Atari computer for $39.95.

Spinnaker Software
215 First Street
Cambridge, MA 02142
(617) 868-4700

Atari, Apple Old West Game

Strategic Simulations, Inc., has created *Rails West*, a simulation of the Western railroad development of the late 1800s, for Apple and Atari computer systems.

Up to eight players may participate, choosing the scenario and level of play, among other options. Menus guide each player through such business decisions as buying and selling stocks and bonds, applying for loans, and floating securities. Economic conditions ranging from boom times to panics are important factors throughout the game.

Rails West is available on disk for $39.95.

Strategic Simulations, Inc.
883 Stierlin Road
Building A-200
Mountain View, CA 94043-1983
(415) 964-1353

The new Volksmodem adapter cable and software allow Atari users to access telecommunications services via a game port.

Atari Telecommunications Package

A Volksmodem adapter cable and software which will allow Atari computer users to gain access to telecommunications services via the game port are now available from Anchor Automation.

The new F Cable allows direct connection of the Volksmodem, a $79.95 telecommunications modem produced by Anchor, to the Atari 400, 600, 800, and 1200 microcomputers through game port 2 without using an Atari Model 850 Interface Unit.

The package has a suggested retail price of $39.95 and includes adapter cable with electronics, one software tape cassette, and one 6-foot telephone cable.

Anchor Automation, Inc.
6913 Valjean Avenue
Van Nuys, CA 91406
(213) 997-6493

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Apple Educational Software

Letters and First Words is the latest program in the "Kids' Corner" line of software by C & C Software. The package contains three programs that help children learn to identify letters, recognize their associated sounds, and begin to spell simple words.

Animated graphics displays introduce letter recognition skills in A-B-C, the first program on the disk. The sound of the letter and both upper- and lowercase letters are shown.

Letter Sounds helps children strengthen their association of sounds with individual letters. Children pick the object that has the correct initial consonant, middle short vowel, or final consonant sound, depending on the skill level.

In the program Building Words, children learn how letters and their sounds work together to form simple words. Children progress from selecting a word to match a picture, to providing letters to complete the word. At the highest skill level, they are spelling simple words.

Letters and First Words is recommended for children in preschool through second grade. The complete package, including disk for Apple II+ or Apple IIe computers, documentation, and keyboard labels, is available for $40. Backup disks are available for $10.

C & C Software
5713 Kentford Circle
Wichita, KS 67220
(316) 683-6056

Jupiter Mission For Atari

Jupiter Mission 1999, an interactive space adventure game, has been released for Atari computers with 48K of memory and a disk drive, by Microcomputer Games, Inc., a division of The Avalon Hill Game Company.

You are aboard the *Space Beagle*, a ship sent to Jupiter to discover the source of mysterious radio signals. Once there, you encounter aliens and must uncover their secret plans.

Eleven interrelated programs on four disks make up the game, which includes arcade segments and a series of puzzles as a part of the adventure.

Jupiter Mission sells for $50.

Microcomputer Games, Inc.
4517 Harford Road
Baltimore, MD 21214
(301) 254-9200

Apple II Utilities Program

Disk O' Utilities, a programming utilities package for Apple II computers, has been introduced by Broadway Software on a DOS 3.3 disk.

Thirteen utilities are on the disk, allowing you to check the number of free sectors with every catalog, find hidden control characters in catalogs and listings, generate automatic line numbers, dump the screen to a printer, undelete files, and a variety of other programming functions.

Disk O' Utilities sells for $12.95 (add $1 for shipping and handling).

Broadway Software
642 Amsterdam Avenue
Suite 136
New York City, NY 10025
(212) 580-7508

New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.

COMPUTE! *welcomes notices of upcoming events and requests that the sponsors send a short description, their name and phone number, and an address to which interested readers may write for further information. Please send notices at least three months before the date of the event, to: Calendar, P.O. Box 5406, Greensboro, NC 27403.* ©

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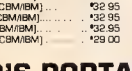

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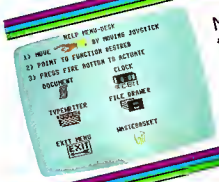

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